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THE NATIONAL TELEPHONE MAGAZINE

SEPTEMBER 15, 1941

TELEPHONE ENGINEER

Priority Granted to Telephone Industry . . . Quantitative Design of Central Office Equipment . . . Wire Chief's Training Course . . . Testing Article . . . Article on Independent Telephone Companies . . . Handbook Tables . . . News

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TELEPHONE ENGINEER

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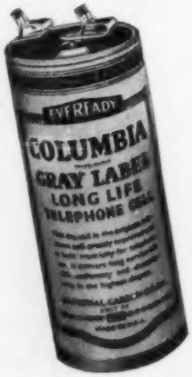

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EDITORIAL

How Much must Telephone Service be Curtailed?

IN a country like this, accustomed to a plenty and in many cases to a surplus of anything it wants, and where the accent has been on the selling rather than on the buying or obtaining of anything, it is difficult for either industry or individual to quickly comprehend a situation where in many of the commonest things are now or shortly will be unobtainable.

Yet that is our present situation. If anyone who reads the newspapers or listens to the radio does not yet realize it, he is due for a sad awakening later.

The basic reasons are simple enough. We no longer have alone the first call upon the materials and food stuffs we produce; they must be divided with other nations, victims of aggression.

The first and most important use of these materials, wherever they are used, is military. Civilian needs must take a back seat. Since the military usage is a great new and super-imposed usage, naturally there will not be enough of these materials for customary civilian use.

This applies to civilian use of materials for telephone service as well as civilian uses of materials for any other purpose.

Under these circumstances it is difficult to see how telephone service, especially that for strictly civilian use, can escape being curtailed. The only questions seem to be (1) What is strictly civilian service? and (2) How much must it be curtailed?

The second question will probably answer itself, since the answer will depend on the ability of the telephone company to obtain the materials, equipment and other things necessary to supply the service. The first question should, in the interest of all concerned—and particularly in the interest of national defense—be answered by those agencies of Government which allocate materials.

The amount of curtailment of civilian telephone service will also depend to some extent upon the ingenuity of telephone managements themselves; ingenuity in the re-use, for instance, of materials retired from plant; ingenuity in making present plant last longer, and in the use of as little vital material as possible in making additions to plant.

The Office of Production Management has already asked the Defense Co-ordinating Committee of the United States Independent Telephone Association to pass the word to Independent telephone companies that they must curtail the use of new materials as much as possible by re-using old materials available to them in stock, in plant, or removable from plant for use elsewhere.

This committee of the national Association has for weeks been trying to obtain from OPM a definite priority rating for the Independent telephone industry. Until September 9th the telephone officials as well as telephone managements recognize as impossible if the telephone industry is to meet even the defense needs of telephone communication.

The delay in assigning a priority rating to the telephone industry has come about, apparently, from the administrative delays in OPM. A reorganization of that agency has now taken place, and it seems likely that a priority rating for essential extension of telephone systems will be created shortly.

Meanwhile, on September 9th, OPM issued an order giving the telephone industry and certain other industries an A-10 priority rating for repair work only. This order, and the method of its application, is described in other columns of this issue of TELEPHONE ENGINEER. Independent companies are advised to study it carefully, because it is the life line to vital and scarce materials for the maintenance of telephone properties.

The important thing about all this, it seems to us, is that Independent companies must be prepared to fit their growth and service, and their method of operation, to the necessities of the situation. This will in practically all cases be an "about face" from past practices and policies. It will in many cases be uneconomic. Things will have to be done that are not in keeping with best engineering and operating practices. All of this will not be easy, but it is going to be necessary.

Every cloud, it is said, has its silver lining. Out of all these things there will no doubt come new practices, substitutions, and possibly new ideas and inventions that will be of lasting benefit to the telephone service. But, whether or not this happens, the situation has to be met in the best way possible. Meeting it is, in our opinion, about the biggest job ahead of telephone companies right now.

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Highlights of the Communications News

Important Communications developments of the past month, briefed for busy readers

by

ROLAND C. DAVIES
Editor, Telecommunications Reports

THE difficulties of the telephone industry in securing materials and equipment for maintenance and repair and essential public services, because of the very stringent shortages of strategic metals, are now nearing possible solution—at least the best available remedy—after weeks of conferences between the defense authorities in Washington and leading representatives of the Bell System and U. S. Independent Telephone Association.

The formation of the new Supply Priorities and Allocations Board retarded the issuance of an OPM order granting defense priorities status to the telephone industry, but when the plan is finally evolved it is anticipated that the industry's needs will be cared for in the best possible manner to preserve the highly important telephone service in the most efficient and uninterrupted manner which can be achieved under the present war emergency conditions. One helpful step occurred during early September in the priorities situation when the Defense Communications Board created a Priorities Liaison Committee to study equipment requirements and to afford assistance and cooperation to the OPM and the DCB on these problems. This committee will consist of a representative from each of the 10 technical committees of the DCB, including the telephone industry committee.

Many other important developments constituted significant problems for the telephone industry on the ever-changing Washington scene. The greatly increased tax burden with the drastically boosted corporation income levies and particularly the Senate proposal of a 10 per cent tax on local monthly telephone bills form immediate "headaches" for the industry. The new 10% local telephone tax, estimated to produce $28,600,000 of additional revenue, which doubled the previous House proposal of a 5% levy, precipitated immediate protests from the industry, especially the Independent field.

ONE bright spot appeared to have arisen on the horizon in the apparent opposition by FCC, Army and Navy authorities to the proposal of Pennsylvania Commissioner Richard Beamish to have drastically reduced long distance rates for soldiers and sailors at their camps and bases. The Pennsylvanian had proposed that the toll rates for the military personnel be established at around 25% of the regular public charges so that the soldiers and sailors could telephone their homes or relatives at night time and on weekends.

Even though this proposal contained aspects of political support, the FCC was loath to break down its principle against discriminatory telephone rates for any particular class of users. A conference was held during the second week of September between the FCC and the special five-member state commission telephone committee on the Beamish proposal. Previously the Defense Communications Board, composed of the leading representatives of the FCC, Army, Navy, State Department and Treasury, had rejected the Beamish plan because of the difficulty of providing this reduced rate service from Army camps and Naval bases due to the increasing shortages of telephone facilities.

The National Association of Railroad and Utilities Commissioners also handled the Beamish proposal with "kid gloves" after the Pennsylvania Commissioner had urged the endorsement of his plan by that group. Commissioner Beamish had presented a resolution to the NARUC on the reduced rate proposal and had announced that he would seek to win Congressional support. The NARUC, however, refused to endorse the plan and merely took the step of transmitting the resolution of Beamish without comment to the FCC, the Senate and House and the War and Navy Departments. The Pennsylvania Commissioner in a speech before the St. Paul convention advocated in a fiery manner his proposal, making an attack on the FCC and disclosing views presented by A. T. & T. officials and War Department representatives in a previous executive conference.

The NARUC convention, however, except for the Beamish proposal, took a most constructive and conservative view of the problems of the telephone industry in regard to its huge defense plant expansion. A trio of Commissioners—Bean of Oregon, Riley of California and Manly of Federal Power—gave most interesting and thoughtful addresses on the problem of amortizing the defense plant during the present period of the emergency as far as possible. **(A detailed summary of their addresses is contained elsewhere in this issue of Telephone Engineer).**

Protests Increased Tax

THE telephone industry sought to make a strong protest to the Senate and House conferees on the new tax bill because of the Senate revision of the levy on local monthly telephone bills raising the rate from 5 per cent to 10 per cent. As the conferees began consideration of the tax measure in its final lap of the bill's Congressional journey during mid-September, the United States Independent Telephone Association, through its member state associations, made strong representations about the harmful effect of this increased tax on local telephone service, especially in the smaller communities and rural districts.

It was brought to the attention of the Congressional conferees that the 10 per cent tax on local telephone service might result in the removal of telephones by thousands of laborers and farmers. Because the Army is especially interested in the development of telephone service in rural districts for civilian defense and air raid warning activity, this contention was also presented to the Congressional group.

The Senate had approved the tax bill with this increase on local telephone bills to 10 per cent and a rising graduated levy on long distance calls above 24 cents. The tax on long distance calls starts at 5 cents for toll charges of 25 to 49 cents and imposes a rate of 5 cents for each additional 50 cents charge. For telegraphic messages, a flat tax of 10 per cent is imposed.

Start Separation Study

THE FCC and the Special Committee of State Commissioners, together with their respective technical staffs, are slated to commence their studies on the difficult problem of formulating standards for the separation of interstate and intrastate telephone property and revenues and expenses with sessions in Washington during early October.

The meeting is to pursue the program which was outlined by FCC Chairman James Lawrence Fly and Wisconsin Commissioner Robert Nixon, the latter being chairman of the special five-member committee of state commissioners to cooperate with the Communications Commission on telephone regulatory problems. It is anticipated that later the FCC-State Commission group will call upon the Bell System and Independent telephone industry to form committees to cooperate in these studies. The FCC also is planning to seek an appropriation so as to secure funds for frequent conferences on separation and other regulatory problems by the state commissioners and their technical staff committee.

The regulation of the telephone industry should be complete cooperation between the FCC and the State Commissions because of the physical nature of the business and its corporate organization with its interstate and intrastate aspects so closely intertwined, FCC Chairman Fly, strongly urged upon the National Association of Railroad and Utilities Commissioners at its recent St. Paul convention.

Advocating a continuous process of regulation rather than "regulation by explosion," Chairman Fly, as discussion leader on the subject of the cooperating committee of the NARUC with the FCC, in special studies of telephone regulatory problems, stated that "cooperation is not something which we can take or leave; it is forced upon us willy-nilly by the physical and corporate structure of the telephone industry." He stressed that "only integration of State and Federal regulatory efforts can match the integration of the telephone industry itself" and "the regulatory problems of the smallest hamlet are based in part upon physical and financial factors routed a thousand miles away and National regulation in turn has repercussions in the smallest hamlet in the land."

Chairman Fly told the NARUC that the FCC, together with himself and Commissioners Paul A. Walker and Ray C. Wakefield, "recognizes and will continue to recognize this interdependence and welcomes the opportunity afforded by the present cooperative program to put that recognition into practical effect." The FCC Chairman's address came after the report of the NARUC special committee for telephone cooperation, delivered by Wisconsin Commissioner, Robert Nixon. Mr. Fly's remarks won the commendation of several state commissioners in the general discussion, being praised by Chairman McDonald of Georgia, Commissioner Nixon, and Chairman Good of Nebraska.

Wisconsin Commissioner Nixon stated that the scope of the joint FCC-NARUC study should include all relations of the Bell System with Independents such as commissions, toll compensation and license contract arrangements.

This proposal of cooperative proceedings between the FCC and the State Commissions is "of the first magnitude," Commissioner Nixon told the NARUC. He urged as imperative that the State Commissions' participation be wholehearted and effective because these nation-wide studies "will be of great aid to State Commissions in exercising their regulatory duties over intrastate telephone business."

Commissioner Nixon briefly depicted the importance of the Bell System, stating that not only is the Bell System the largest business corporation in the world but that "no other public service is used so much by so many unless it be the Federal Postal System." Citing that the Bell System is not only the largest private employer of labor in the United States but has stockholders throughout the country, he noted that the System exercised a powerful influence upon the economy of the country through its purchases of supplies and materials and use of banking facilities. He cited that Bell System telephones have increased more than 100% during the past 20 years with a rate of growth now exceeding 1,000,000 stations per year.

Chairman Fly asked that the FCC and State commissions plunge into the seven-point group of topics with separation as the first objective but depreciation as another most important problem. Citing that to expect the complete agreed-upon formulation of principles on all of the seven points would mean by a miracle "a new and golden era" in telephone regulation, Mr. Fly said that realistically he knew pension costs and Western Electric costs, depreciation, separation and rate of return "will be argued over—and litigated over—long after the reports of our cooperating committee have been received and acted upon." He added that the promise of progress is there and in the right direction.

On depreciation, Chairman Fly said the Bell System's depreciation practices "are in general fraught with contradic-

(Please turn to page 30)

Convention Dates

Arkansas Telephone Association, Arlington Hotel, Hot Springs September 22 and 23.

Association of American Railroads, Telephone Section, Hotel Gibson, Cincinnati, Ohio, September 23, 24 and 25.

South Dakota Telephone Association, Hotel Carpenter, Sioux Falls, October 8 and 9.

United States Independent Telephone Association, Hotel Stevens, Chicago, October 14, 15, 16 and 17.

Independent Pioneer Telephone Association, Hotel Stevens, Chicago, October 16.

Virginia Independent Telephone Association, Hotel Roanoke, Roanoke, October 23 and 24.

North Carolina Independent Telephone Association, Pine Needles Inn, Southern Pines, October 27 and 28.

South Carolina Independent Telephone Association, Lafayette Manor, Myrtle Beach, S. C., November 3 and 4.

Florida Telephone Association New Florida Hotel, Lakeland, November 7 and 8.

Alabama Independent Telephone Association, November 13 and 14.

Tennessee Independent Telephone Association, Hermitage Hotel, Nashville, November 17 and 18.

Kentucky Independent Telephone Association, December 2 and 3.

Telephone Industry Granted Priority of A-10 by OPM

A new and streamlined plan to grant priority assistance for repair work in the telephone industry was announced Sept. 9, in a news release No. PM1116, by Donald M. Nelson, Director of Priorities. It represents an effort to keep American defense industries running at full speed, and to prevent any break in the increasing tempo of defense production. The new plan takes the place of the Maintenance and Repair Order which was announced August 8, but which was never actually issued because of administrative difficulties in handling the paper work it would have involved.

The new plan, which becomes available immediately, is set up along simple lines. It provides machinery under which priority status for repair work in the telephone industry can be obtained, so that firms in these classifications may obtain repair parts promptly.

The revised scheme permits qualified telephone companies or suppliers to apply a perference rating of A-10 to deliveries of required repair parts by endorsing a special statement on purchase orders, certifying that the material being ordered is for repair work under the terms of the order, P-22.

The order can be used also to get deliveries for "emergency inventory."

Repairs are defined in the order as repairs needed because of an actual or imminent breakdown. Emergency inventory is defined in the order as the minimum inventory of material required to provide for repairs to meet an actual or imminent breakdown.

The present order is designed primarily to protect industry against sudden breakdowns and is regarded as an interim measure. The entire inventory problem is to be studied further with a view to providing broader priority assistance. It is felt, however, that the present plan will keep the essential industries covered running on their normal basis and will prevent serious interruption to defense production by giving telephone companies a simple method for obtaining vital repair parts.

As we interpret the order, the preference rating of A-10 is assigned to deliveries to a telephone company of Material required by him for Repairs or for his Emergency Inventory; and to deliveries to a Supplier of Material which is, in turn, to be delivered to a telephone company for Repairs or for his Emergency Inventory or to be physically incorporated in Material to be so delivered. Those entitled to apply a preference rating are (1) a telephone company (2) a Supplier, providing he requires the Material so purchased in order to make deliveries rated as above.

To apply for a Preference rating we quote the order:

"A telephone company in order to apply the preference rating to a delivery ot material to him must endorse the following statement on the original and all copies of the purchase order or contract for such Material signed by a responsible official duly designated for such purpose by such telephone company.

"Purchase Order for Repair or Emergency Inventory-Preference Rating A-10 under Preference Rating Order P-22."

"Such endorsement shall constitute a certification to the Office of Production Management that such Material is required for the purposes stated therein. Any such purchase order or contract shall be restricted to material the delivery of which is rated in accordance herewith.

"A Supplier in order to apply the preference rating to a delivery of Material to him must endorse the following statement on the original and all copies of the purchase order or contract for such Material signed by a responsible official duly designated for such purpose by such Supplier:

"Purchase Order for Material required to fill a duly rated order for Repair or Emergency Inventory. This purchase order bears Preference Rating A-10 under Preference Rating Order P-22."

"Such endorsement shall constitute a certification to the Office of Production Management that such Material is required to fill an order placed by a Producer or Supplier duly rated in accordance herewith. Any such Supplier's purchase order or contract shall be restricted to Material the delivery of which is rated in accordance herewith.

"A producer or Supplier placing any such rated purchase orders or contracts and the Supplier selling the Material covered thereby, must each retain endorsed copies of such purchase orders or contracts segregated from all other purchase orders or contracts for a period of two years from the date thereof for inspection by authorized representatives of the Office of Production Management.

"The Preference Rating hereby assigned shall not be applied by a telephone company to obtain Material in excess of their requirements for Repairs or for their Emergency Inventory; (2) unless the Material to be delivered cannot be obtained when required without such rating; (3) by a Supplier to obtain Material in excess of the amount necessary to make rated deliveries."

The Order states that penalties for false statements will be applied. It also provides for revocation or modification. The effective date of the order is September 9, 1941, and unless sooner revoked shall expire on February 28, 1942.

In checking with the Chicago office of the OPM they inform TELEPHONE ENGINEER that this new order is very simple in application and all that is necessary is for the telephone company or supplier to add to the contract or purchase order the statement designated for each carried in above paragraphs of instructions copied from the order. In our opinion "emergency inventory" consists mainly of materials such as protective devices, pole lines hardware, or for that matter almost all supplies needed to combat imminent or actual breakdown.

Telephone companies can greatly assist themselves and their suppliers by applying this preference rating of A-10 on their order being sure in the process that they copy word-for-word the statement carried herein on their purchase orders from this date. This order should facilitate more rapid delivery and leave telephone companies in position to combat emergencies and have an emergency inventory that has probably gotten low during this emergency.

H. O. Dutter Dies

Herman O. Dutter, director and until recently general manager of the Elyria (Ohio) Telephone Co., director of the Warren Telephone Co. and a member of the Ohio Independent Telephone Association, died at his home in Elyria, July 29, after a brief illness. He was 68 years of age. Mr. Dutter's death was a sudden shock to his many friends and relatives.

Affiliated with the Elyria Telephone Co. since 1920, Mr. Dutter had quite a reputation as a telephone man throughout the state for his conservative opinion regarding telephone matters. He was a member of the Independent Pioneer Telephone Association.

I. T. & T. Has Station Gain

Telephone operating subsidiaries of the International Telephone and Telegraph Corporation in nine countries report an aggregate net gain of 30,634 telephones in service during seven months of 1941.

FCC Transmits Proposed Amendments On Uniform Accounts

PROPOSED amendments of instructions for Class A and B telephone companies under the Uniform System of Accounts for the establishment of a Continuing Property Record, together with a draft of standard practices for that phase of accounting were transmitted by the FCC in early September to the telephone industry, Bell System and Independents, with the request that their comments be submitted not later than October 15, 1941.

The FCC letter to the Bell System and the United States Independent Telephone Association stated that the proposd regulations are "designed to be a sufficient elaboration of those now in effect to indicate in general terms the minimum content of the required record and the scope of procedure deemed adequate to meet the essential regulatory objective without prescribing standard forms for all companies and with out unnecessarily disturbing acceptable current routines".

The underlying keynote of the proposed Continuing Property Record reregulations was that the telephone companies with CPR methods already establishd in a satisfactory manner or meeting the requirements of state commissions can continue their systems. With this end in mind the proposed Instruction 26 (Section 31.2-26 of the FCC Rules and Regulations) in its paragraphs (b) cited that "not later than June 30, 1942, each carrier shall file with this Commission a complete plan of the method to be used in the compliation of a continuing property record."

The text of the proposed amendment of Instruction in its paragraph (d) 26 explained the Continuing Property Record in the Uniform System as follows:

"The record shall be arranged in conformity with the plant accounts prescribed in this system of account. It shall be compiled on basis of original cost (or other book cost consistent with the provisions of this system of accounts) and shall contain such detailed description and classification of property units as will permit of its ready verification. It shall be so designed as to permit ready attainment of its principal objectives, such as proper and expeditious retirement accounting, facility in estimating the cost of further property changes, verification of original cost or of inventories of plant (or of other property represented in the record), and determination of mortality characteristics. The record shall accordingly reveal clearly, in relation to designated accounting areas, detailed and systematically summarized information as to the kind, character, size, quantity, location, date of installation, ownership, and actual or apportioned original (or other appropriate book) cost of the telephone plant or other units aggregately represented by the concurrent balances in accounts 100.1, 'Telephone plant in service, 100.3 'Telephone plant held for future use,' and 103, 'Miscellaneous physical property.'"—R. C. D.

Entertainment Committee Appointed

Geo. W. Rodormer

President George W. Rodormer, of the Independent Pioneer Telephone Association, has announced the appointment of the Entertainment Committee to be in charge of the Pioneer banquet on Thursday night, October 16, during the 45th annual convention of the United States Independent Telephone Association.

Those selected to serve as the 1941 committee are: Chairman, R. C. Reno; secretary-treasurer, Ray W. Smith; W. S. Cadwell, T. S. Gary, James H. Kellogg, W. J. Pfaender, E. Winston Rodormer, and Norman S. Shenk, all of Chicago; and E. O. Link, Galion, Ohio. At their first meeting this committee drafted George Rodormer and John F. Jaap, chairman and secretary-treasurer, respectively, of the 1940 committee, as ex-officio members.

Since its appointment the present committee has held several meetings, and plans are now under way for the 1941 Pioneer banquet.

The committee has adopted a new plan for the distribution of tickets for 1941 which will enable each registrant of the convention to pay a minor part of the cost of his ticket and reserve his seat for the banquet at his convenience. Through the cooperation of manufacturers and suppliers serving the industry, the entertainment committee has made arrangements for the Pioneer association to offer the tickets at a price of only $1.50 each. Manufacturers and suppliers are making contributions to cover the balance of the cost of the banquet and entertainment, the total cost of which will be approximately $5.00 per person.

With the adoption of this new plan of allotting tickets at the registration desk, exhibitors will not have any tickets to distribute before or during the convention as heretofore and no registrant will be allowed to purchase tickets for others than his immediate family. This plan will make it possible for registrants to select their banquet table on a basis of "first come, first served"—although before the entertainment begins all tables will be removed from the banquet hall to enable those attending to better view the entertainment.

Mexican Telephone Strike Settled

Fifteen hundred employees of the Mexican Telephone Co. went back to work Aug. 30, following settlement of a strike which affected 75,000 subscribers throughout the nation. The workers received small wage increases, considerably less than they had originally demanded.

QUANTITATIVE DESIGN OF CENTRAL OFFICE EQUIPMENT FOR SMALLER TELEPHONE OFFICES

By JAY G. MITCHELL

Basic Factors

WITHOUT any intention of coining a new expression for a field which is already adequately supplied with terms having specialized significances the process of arriving at a decision as to **how much** of each element of new or modernized Central Office Equipment is required to supply the previously determined demands for service in a given telephone office has, for brevity's sake, been called Quantitative Design of Central Office Equipment. The telephone company executive who is confronted with the many problems associated with the installation of new, replacement of old or extension of existing Central Office Equipment must give the most careful consideration to a few controlling factors. These are the factors which are the basis of the decision as to what capacity in each part of the whole central office equipment is to be specified for meeting service demands presently existing and also what future capacity shall be envisioned in each part to meet the probable demands for service ultimately.

One of the important cases in this general problem is the Quantitative Design of Central Office Equipment for an **entirely new office** to be located in territory previously served by an existing office which is to be relieved of the load assigned to the new office. In this work full participation is in order from the Plant, Commercial, Accounting and Traffic and it must be assumed that the necessary studies have been made and the basic data has been developed on which may be based the determination of **how much** of each element of the equipment to be purchased and installed is required. In other words development studies, traffic studies, plant surveys and the canvass of available sites, in the case of entirely new offices, are all preliminary to the development of the quantitative design of the Central Office Equipment. The same is true of those considerations which dictate the type of equipment which is to be used, all of which must be decided along with such study and consideration of circuit details and operating efficiency as may be deemed essential.

Each of these preliminary studies is an interesting and important element in the problem of establishing the specifications for a new exchange and will be separately treated because the design, quantitatively, of new Central Office Equipment brings together and merges the results of all and starts on the assumption of their prior completion.

Essential Data

THE quantitative design of Central Office Equipment in any telephone exchange is somewhat of an exact science and unnecessary guess work must be eliminated. This is because equipment in excess of the requirements involves totally unnecessary capital investment in the beginning and imposes expenses for fixed charges and depreciation which can not be recovered. This is because such excess equipment is likely to be not used and non-useful in the service of the public. On the other hand if inadequate provision is made in the amount of equipment to supply the predetermined service demand then the shortage must be rectified at comparatively great cost and expense in order to maintain the standards of service imposed by an educated public demand. When inadequate Central Office Equipment is installed, even when it is of the most modern type, the temporarily impaired service due to the inadequacy that must be furnished during the period required to rectify the shortage may well forfeit any public approval due to the promised improvement. For these reasons and others it is important that the most complete data as to the requirements of the office shall be available before any effort is made to write preliminary specifications. The arrangement and size of the quarters in which the proposed new equipment is to be installed will obviously have an important effect on its type and other characteristics but they are especial factors not applying in each office and must be accorded their proper weight as a matter of **local** and special adaptation. It is with the factors which are of a general character and which affect all installations that we must be concerned here. The controlling factors of universal application in designing Central Office Equipment quantitatively are the following:

A. The number of circuits which will be brought into the office initially. (Usually this will be the number of cable pairs entering the office).

B. The number of circuits which the forecasts show will be brought into the office ultimately.

Note:—Both A and B include, of course, subscribers' circuits, toll circuits (including free service circuits), rural circuits, trunk circuits, private circuits

(Please turn to page 49)

Wire Chief's TRAINING COURSE

SECTION VII

Open Wire Construction

(Prepared Expressly for TELEPHONE ENGINEER by the Lincoln Engineering School)

General

ALTHOUGH cable has largely replaced open wire in town and city plants and to some extent on the important toll routes, nevertheless open wire is still the chief medium for serving rural subscribers and for all except the major toll lines. Open wire has the advantage over cable of being quite flexible as it permits circuits to be added to or removed from an existing lead as conditions require. It is also relatively imperishable and thus may be expected to give service for many years. On the other hand it is very vulnerable to storm damage, particularly in regions subject to heavy sleet and wind storms, and may require considerable maintenance expense where heavy tree growth is involved along the right-of-way.

From a transmission standpoint open wire is more subject to interference from power lines than cable but has materially lower transmission losses, hence may be used for longer distances without telephone repeaters.

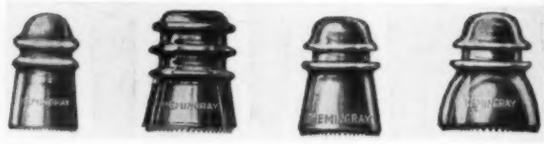


Fig. 1—Standard Types of Insulators.

It is interesting to note that the method of supporting telephone wires on glass insulators has changed but little in the past thirty years. Substantial progress has been made however in wire splicing methods and in improvement of the conductor material.

A prime consideration in open wire construction is adequate clearance over highways, railroads, driveways, and from nearby power wires and power structures. Carelessness in observing the standard clearances specified by the **Bureau of Standards Safety Rules** and State Laws may result in serious injury to the public or to telephone workmen and consequent damage suits. Table No. 1 and No. 2 specify clearances over railways, roadways, driveways, etc. and from power lines of various voltages.

Table No. 1—Telephone Wire and Cable Standard Vertical Clearances over Roadways, Driveways, and Railroad Tracks.

Nature of Crossing	Minimum Vertical Clearance in Feet
Top of Steam R.R. tracks	27
Streets and Highways	18*
Private Garage Driveway	10
Where wires parallel a road and only pedestrians pass under the wire	8

*In some states laws specify 20 feet and the local laws should govern.

Table No. 1—Standard clearances over roadways, driveways, R.R. tracks.

Types of Wire

THERE are four kinds of open wire in general use in telephone plant, viz:

1. BB Galvanized Iron wire
2. High Tensile Strength Galvanized Steel Wire
3. Hard Drawn Copper Wire
4. Copper Covered Steel Wire (Copperweld)

Until recent years most of the rural and minor toll lines were constructed of No. 109 (12 B.W.G.) BB Galvanized Iron wire. The present trend is toward the use of the new high strength No. 109 (12 B.W.G.) Galvanized Steel wire or No. 102 (No. 10 A.W.G.) Copperweld.

The high strength galvanized steel wire is available in two types generally referred to as type 85 and 135 respectively. The chief difference between the two types being in their breaking strength, the No. 85 having a breaking strength of 793 lbs. and the No. 135 a breaking strength of 1213 lbs.

The high strength steel wire makes possible the use of materially longer spans than was practicable with ordinary BB No. 12 Iron wire.

(Please turn to page 38)

Fig. 2—Western Union Type of Hand Splice.

Personals from the Field

Zack Carter, owner of the Steffenville (Mo.) Telephone Co., petitioned the Missouri commission for authority to sell the exchange to **B. C. Humphrey** and **B. B. Buchanan** during the latter part of August.

•

Richard H. Gregory, comptroller of Western Electric Company for more than 30 years, retired August 31, after 43 years of Bell System service. **S. Wallace Murkland,** assistant comptroller since 1927, has been elected a director and will succeed **Mr. Gregory.**

•

J. A. Riordan, president of the Morrison (Ill.) Telephone Company, has just completed work on a new 25 year franchise from the local Morrison City council.

•

Margaret Ostot, secretary to H. M. Stewart, executive secretary of the Pennsylvania association, is now **Mrs. Gerald Proudfoot.** Altho late, our best wishes are sincere.

•

Leo Gilbert, for many years Plant Superintendent of the Hoopeston (Ill.) Telephone Company, is the new Plant Superintendent and Wire Chief of the Altamont, Ill., exchange of the National Trail Telephone Company. **C. D. Parsons,** formerly a district manager of a Kansas exchange of the Western Power and Telephone Company, is now installer at Altamont.

•

Richard T. McComas, 92, and until his death the oldest Bell pioneer, died in Montclair, N. J., August 17. He was a retired vice president of the Cincinnati Bell Telephone Company.

•

Louis Pitcher, executive vice president of the U. S. Independent Telephone Association, found it necessary last week to cancel his speech before the 3-State convention of Maine, New Hampshire and Vermont, at Bretton Woods, N. H., because of the 10% tax proposal that made it imperative that he be in Washington.

•

Samuel H. Bomberger, president of of the Schaefferstown (Penn.) Rural Telephone Company, was buried August 24. He was active in civic affairs and a leading citizen of his community.

S. A. Lane

S. A. Lane, president of the Arkansas Telephone Association, is very busy these days completing plans for the convention of that Association scheduled at Hot Springs on September 22 and 23. Gus has attended many of the state conventions this year and hopes to greet a good many out of-state visitors at this meeting.

•

Stuart Sommer, sales manager of the T. J. Cope Company, Philadelphia, Penn., dropped by our office early in September while in Chicago. He reports very nice business from the telephone industry and better still, told us that his company is profiting from their advertising in TELEPHONE ENGINEER. Thank you, Stuart.

•

R. B. Fegan, general manager of the Junction City (Kan.) Telephone Company has announced that new Stromberg-Carlson switchboard equipment to accommodate approximately 400 more telephones will be ready for use about October 1. Junction City has been hard pressed for several months by expansion necessary to handle nearby Ft. Riley.

•

Harry Huether, well known to many of you as General Commercial Manager of the Pennsylvania Telephone Corporation, has been named vice president to fill the vacancy caused by the death of M. E. Southworth some months ago.

•

Leland Wright, whom we all know as manager of the Alexandria (Minn.) Telephone Company, is slowly recovering from his recent illness but is not expected to become active again for some 60 days.

•

E. L. Lamer, formerly manager of the Highland exchange of the Illinois Commercial Telephone Company has been transferred to Kewanee as wire chief. **Earl W. Johns,** of Chester, succeeds Mr. Lamer. **G. A. Fike** has been promoted from manager at Pinckneyville to manager of Chester and **Joe Watts, Jr.,** repairman at DuQuoin becomes manager at Pinckneyville.

•

George M. Kloidy, secretary of the Nebraska Telephone Association, has called district meetings at Cambridge, Neb. for September 16 and Norfolk on September 18.

•

Mrs. Marie Nocker, has assumed managership of the Hebronville (Tex.) exchange of the Del Rio & Winter Garden Telephone Company following many years service as chief operator at Sabinal, Texas.

•

Carl Traver of Haddam, Kansas, some years ago manager of the United Telephone Co. exchange at Norton, Kas., now Southwestern Bell, has recently purchased the Courtland (Kas.) Telephone Company from the Tucker family. **Robert Weborn,** son-in-law of Mr. Traver will operate the Courtland property. Mr. Traver owns the exchange at Haddam.

•

Ruth Gordon of the Pennsylvania Telephone Corporation is responsible for those attractive Indian Summer invitations to the Pennsylvania Association Accounting Conference.

•

Chas. C. Deering, secretary of the Iowa Independent Telephone Association, is busier than a blunt nosed termite of late because of the district meetings being held in Iowa this month. Those remaining after date of this issue are Sept. 16, Mt. Pleasant; Sept. 17, Tipton; Sept. 18, Grinnell, and Sept. 19, Dows. Three or four additional meetings yet to be held are not scheduled as yet.

•

Tyler Ryan, manager of the Humboldt, Nebr., exchange of the Lincoln Tel. & Tel. Co., recently demonstrated

(Please turn to page 36)

Testing Switchboard Circuits and Equipment

Part II

By J. S. REED, JR.

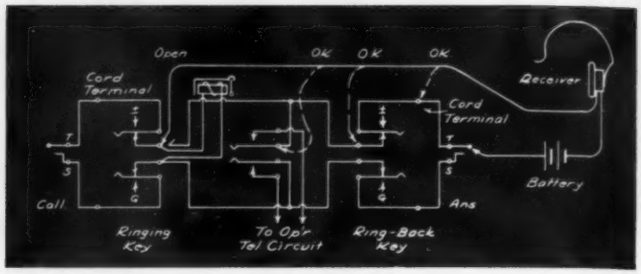


Fig. 6—Method of Locating an Open in a Magneto Cord Circuit.

Cord Circuit Tests in Magneto Switchboards

FOR cord circuit tests of a routine nature in magneto exchanges, a vacant jack may be connected to one or two dry cells to provide a convenient way of testing cord circuits. The answering cord of the circuit being tested is plugged into this jack and the head receiver connected to the sleeve and tip of the calling cord (Figure 5). Listening tests are made while shaking the cord, rotating the plug in the jack, and moving key levers sidewise. The slightest noise in the circuit resulting from these operations can be easily detected, since a continuous path exists through the entire cord circuit from the battery to the receiver and the slightest break in this path is instantly manifested by clicks or a scratching noise in the receiver.

It should be noted that this method cannot be applied to the testing of cord circuits when the answering and calling cords are isolated by repeating coils or condensers, or in cases where there is a short or open in this circuit for the reason that the path of the battery current to the receiver is broken. This calls for the use of a different method in which the head receiver is connected in series with dry cells and utilized to test parts of the circuit through which the battery current will pass. For such tests an ohmmeter may be substituted for the head receiver and battery to obtain more accurate testing results.

To locate an open in a circuit, one clip of the test set is connected to a selected starting point such as the tip or sleeve of the answering plug and then, with the test prod, exposed terminals or lugs are touched one by one in a progressive order through the circuit until a point is reached where no click is heard in the receiver. The clip of the test set is then moved to the last terminal touched prior to the one beyond the open. This portion of the circuit is again checked with the test set to verify the presence of the open. A visual examination at this point will usually reveal the cause of the open. The method of locating an open in a cord circuit is shown in Figure 6.

To locate a short, the clip of the test is connected to the sleeve of the answering cord of the affected circuit, and the presence of the short is varified by touching the tip of the plug with the prod (Figure 7). A loud click denotes a direct short, while a fainter click may be due to the resistance of the clearing out drop coil or the repeating coil winding. If a short is indicated, one of the cord conductors is disconnected at the terminal strip in the rear of the switchboard and the test set connected across the cord conductors (or the tip and sleeve of the plug) to ascertain if the short is in the plug. If the cord tests clear, the test is made from the cord terminals to the ringing and listening keys, inserting cardboard insulators between contact springs to isolate parts of the circuit as illustrated in the figure. The test is continued in progressive order toward the calling cord until the short is located. The short will be found to be between a normally clear portion of the circuit and the last terminal which should have tested clear.

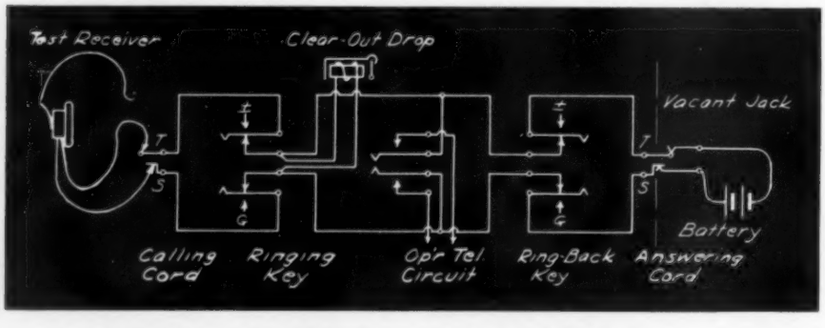


Fig. 5—Testing Simple Type of Magneto Cord Circuit.

Circuit Testing in Common Battery Switchboards

CIRCUIT testing in common battery switchboards is complicated by the presence of elements such as relays and switchboard lamps not found in magneto switchboards, also by the introduction of battery feed into the circuits. Greater reliance must be placed upon the use of circuit diagrams to locate faults, since it is very difficult, if not impossible, for the maintenance man to remember more than a mere outline schematic of the various circuits of the common battery switchboard. Figure 8 illustrates a typical line and cord circuit and indicates the resistance of the circuits.

The same testing instruments previously described may be used for

(Please turn to page 50)

Independent Telephone Companies

H. M. Pope

By H. M. POPE

Co-operation between These 6,400 Organizations, Serving 20 Per Cent of All Telephones in the Country, and the Bell System Is Vital in Providing a Nation-wide Telephone Service

PEOPLE living in areas served by Bell telephone companies may not have occasion to know that, in addition to the 24 operating companies included in the Bell System, there are some 6,400 other telephone companies whose management and personnel play a most important part in giving the United States what is often termed "the best telephone service in the world."

These companies are independent of the Bell System, except that there is a physical connection of their lines with the lines of the adjacent Bell company in order to bring about a universal telephone service nationwide in its scope.

Because of this physical connection, these companies are known to Bell System people as "connecting companies." They own and serve about 4,400,000 telephones, or approximately 20 per cent of the more than 22,000,000 telephones in the country; they have 10,000,000 miles of wire; they handle in the neighborhood of 19,000,000 local and toll conversations every day.

That the high standard of telephone service in the United States reflects a high degree of cooperation between the Bell and connecting companies must, of course, be apparent. To it President Gifford of the American Telephone and Telegraph Company paid tribute in his report on the Company's operation for 1940 when he said: "this cooperation is invaluable in marshalling the resources of the entire telephone industry in the interest of national defense."

Without such cooperation, telephones could not be so quickly and readily connected one with another, for obviously there is a most complex operating problem involved in so combining the properties of thousands of companies that anyone anywhere can pick up a telephone and talk to anyone else anywhere else. It is to point out some of the features of this cooperation, which results in a combined network handling about 100,000,000 local and toll conversations a day, that this article has been prepared.

The 6,400 connecting telephone companies are scattered over the entire country, having exchanges in every state except Delaware. A map prepared by the United States Independent Telephone Association in 1938, Figure 1, shows the widespread distribution of 12,000 independent telephone exchanges. In several states the connecting companies serve a larger geographical area than that served by Bell System companies.

Connecting companies vary in size from those with only one exchange having not more than 10 telephones to those having more than 100,000 telephones located in a number of exchanges. Some of these companies have their own toll lines connecting several exchanges, while others have no toll lines. There are seven connecting companies having more than 50,000 telephones each, two of which, the Associated Telephone Company, Ltd. (California) and Rochester Telephone Corporation (New York), have more than 100,000 telephones.

Many connecting companies are not financially affiliated with any other company or corporation. Some, however are members of so-called group companies which own the controlling interests in a number of telephone companies operating in several states. The largest three group companies are General Telephone Corporation, with 532,000 telephones; Telephone Bond and Share Company, with 240,000; and United Utilities Company with 98,000 telephones.

Ohio has a larger number of connecting company telephones than any other state, while Maryland has less than 800. The 10 states having the largest number of connecting company telephones are shown in Figure 2.

State	No. of Connecting Company Telephones As of January 1, 1941
Ohio	322,000
Illinois	312,000
Indiana	278,000
Iowa	247,000
Pennsylvania	223,000
New York	220,000
California	203,000
Missouri	188,000
Wisconsin	170,000
Texas	147,000

Fig. 2

In these ten states there are about 2,310,000 connecting-company telephones

It became apparent to the non-Bell telephone companies prior to 1900 that some form of central organization was needed in order to provide assistance in respect of the many difficult problems frequently encountered in furnishing reliable telephone service. As a result, the National Independent Telephone Association was formed, and later a second organization, the Independent Telephone Association of America, came into being. These two associations were merged in 1915 to become the present United States Independent Telephone Association, the by-laws of which state: "The object for which it is formed is to aid the Independent telephone industry and to furnish to its members information and advice upon all subjects relating to telephony; and to authorize its officers or committees to represent the Independent telephone interests before any commission, executive officer, legislative or regulatory body of the United States or any state."

One of the first activities of the United States Independent Telephone Association was to encourage the formation of state associations to work in cooperation with the national body. There are now 32 state associations. These provide a clearing house for information of interest to their members through annual meetings, frequent group meetings, through advice on problems of all kinds relating to the industry, and through their relationship with the United States Independent Telephone Association. There have been many evidences of cooperation between the Bell System companies and the connecting telephone companies and their state and national associations. Problems of mutual interest, including those dealing with the interchange of toll messages, frequently are discussed at the state association meetings as well as at meetings of the United States Independent Telephone Association. The national and state associations have been of great value to connecting companies throughout the country.

ANOTHER indication of the important part connecting companies play in the industry is the fact that during 1940 about 94,000,000 interchanged toll messages were originated by customers of connecting companies. The services performed by connecting companies in the handling of so many millions of interchanged toll messages vary considerably, of course. In all cases the connecting company bills and collects the charges for Bell toll messages sent paid or received collect by is customers, and it performs the inward toll operating on all messages that terminate in its exchanges. In some cases the connecting company operators handle to completion (supervise, time, and ticket) toll messages which originate in their exchanges, while in other cases originating messages are routed to another connecting company or to a Bell exchange for handling. Exchanges in which all originating toll messages are routed to another office for handling are called full tributary exchanges. In some cases a connecting company operator handles to completion certain originating messages, usually those destined to points to which the originating exchange has direct circuits, while the remaining originating messages are routed to another office for handling to completion. These exchanges are called AB or CLR tributaries. The exchanges at which all originating messages are handled are called toll centers.

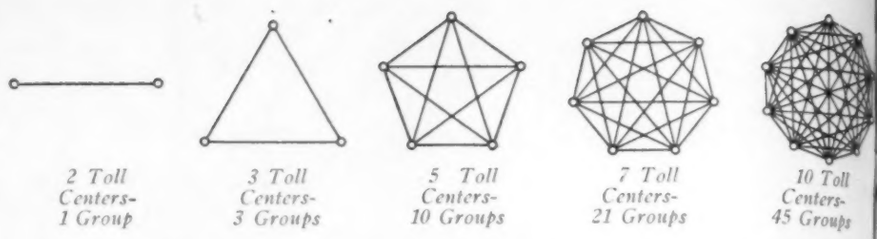


Fig. 3—Groups of Toll Circuits Required for Direct Connections between various Numbers of Toll Centers.

Handling Interchanged Messages

THE relationships growing out of the exchange of millions of toll messages between connecting companies and Bell companies cover practically every phase of the business. Only through the closest cooperation is it possible to coodinate the efforts of both groups so that a high grade of telephone service will be provided. This involves not only the provision of adequate plant, as to both grade and quantity, but also the use of such traffic operating methods and routings as will achieve speed and accuracy in the handling of the messages to and from all points encountered in nationwide service. Toll messages may originate anywhere and likewise terminate anywhere, and the prompt and efficient handling of the millions of such messages requires carefully throughout operating methods and practices.

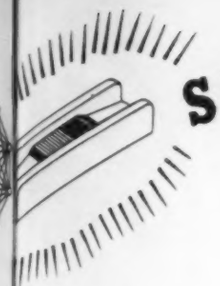
In order to achieve a universally good telephone service on calls between any two customers, regardless of where they are located or whether they are customers of a Bell company or a connecting company, it is necessary to provide toll circuits in such numbers and so arranged that satisfactory connections may be established quickly. Toll connections may require operators at a number of telephone central offices along the route to connect together toll lines in order to build up the toll circuit between the calling and called customers. These points of connection are referred to as "intermediate switching points" or "switches." Each additional switch introduced in a built-up toll connection increases the time required to establish the connection and reduces somewhat the volume of speech transmitted. The telephone plant must therefore be designed so that the standards of transmission and number of switches required on any call will be such that satisfactory transmission of speech will be provided. The toll calls on which it is most difficult to give a high grade of service are those scattered calls between customers located in remote and widely separated exchanges, because it is difficult to establish such connections and still keep the number of switches to a minimum.

From the standpoint of improved service to the customer, it is desirable, whenever feasible, to provide operating practices that will permit the calling customer to remain at his telephone while the connection is being established. Any improvements in equipment or operating practices that reduce the time of establishing connections or in other ways improve the services to customers are extremely important and are being continually studied.

SINCE 1925 the speed of service of toll calls handled by Bell Companies has been improved from an average of 7.3 minutes to 1.4 minutes at the present time. It has long been recognized that to give an efficient and speedy service requires methods of operating such that an operator anywhere in the country will understand the request of any other operator anywhere else in the country. Obviously, these matters require close cooperation between Bell and connecting companies, and the service today exemplifies such cooperation. The modifications and changes made from time to time in central office equipment, outside plant, and operating practices have permitted the satisfactory handling of toll business which has grown tremendously over the years. The connecting companies have done their share in contributing ideas as to improvement of both equipment and operating technique.

It was early recognized that to provide an adequate number of direct toll circuits from each toll center to every

(Please turn to page 42)



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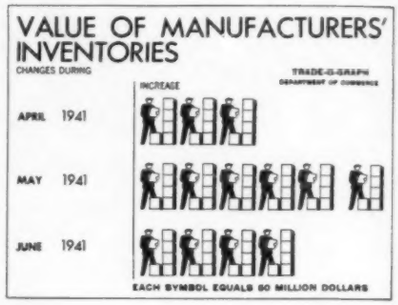
Highlights of the Communications News

(Continued from page 18)

tions" and property on which the Bell Companies had collected an appreciable portion of their original investment so far as their own depreciation expense account is concerned is claimed to be almost as good as new when the companies are calculating their rate base." He declared that the FCC—State Commission cooperation "can bring order out of the present chaos of depreciation contradictions—with a tremendous saving to telephone users as a result."



A. T. & T. Vice President Harrison Directs All OPM Production Activities

ONE of the outstanding communications engineers of the world, William H. Harrison, Vice President and Chief Engineer of the American Telephone and Telegraph Co., who has been engaged in important posts with the National Defense program since July, 1940, was elevated to the directorship of the Production Division of the Office of Production Management in the recent reorganization of OPM. One of the outstanding communications engineers in the world, Mr. Harrison succeeded John D. Biggers. His designation was a tribute to the notable and successful work which the A. T. & T. executive has performed in directing the construction of hundreds of Army and Navy bases and defense plants and setting into motion the tremendous Naval and merchant marine shipbuilding program.

It was understood that both the White House and OPM Director General William S. Knudsen sought the services of Mr. Harrison in his new post of supervising the production of all finished defense and armament materials and equipment, covering the very wide range of ordnance, munitions, aircraft, tanks, food, clothing, medical and other supplies for the Army and Navy and Lend-Lease aid to Great Britain, Russia, China and other democracies. Mr. Harrison will have under his direction the greatest production program in world history as next year's defense expenditures and supply activities will be increased to at least double the present program.

Ever since he came to Washington on leave from his A. T. & T. position, Mr. Harrison has made one of the most outstanding reputations of any industralist in the defense organization. He has won the complete admiration and confidence of the top-ranking Army and Navy officials and is also very popular among the New Deal leadership. The A. T. & T. Vice President joined the defense program when Mr. Knudsen named him Director of Construction with the National Defense Advisory Commission. When OPM was created he became, on Jan. 18, 1941, Chief of Construction, Shipbuilding and Production of Supplies other than ordnance and aircraft.

Settlement Reached on Western Electric-Installers' Union Negotiations

AS was anticipated, an amicable settlement of the controversies between the Western Electric Co. and the Association of Communications Equipment Workers, the independent union for that company's installers, was reached after lengthy negotiations with a panel of Federal Conciliators of the U. S. Department of Labor. The agreement ended the widely publicized threats of a nationwide telephone stoppage which the ACEW had claimed might occur if the 9,000 Western Electric installers had gone out on strike.

After 61 hours of almost continuous negotiations, the Western Electric and the ACEW reached a settlement which included a blanket 6 cent an hour wage increase, recognition of the union as the sole collective bargaining agency for the employees concerned, and agreement on seniority rights and the principle of arbitration.

See our October Convention Number for Exhibit News

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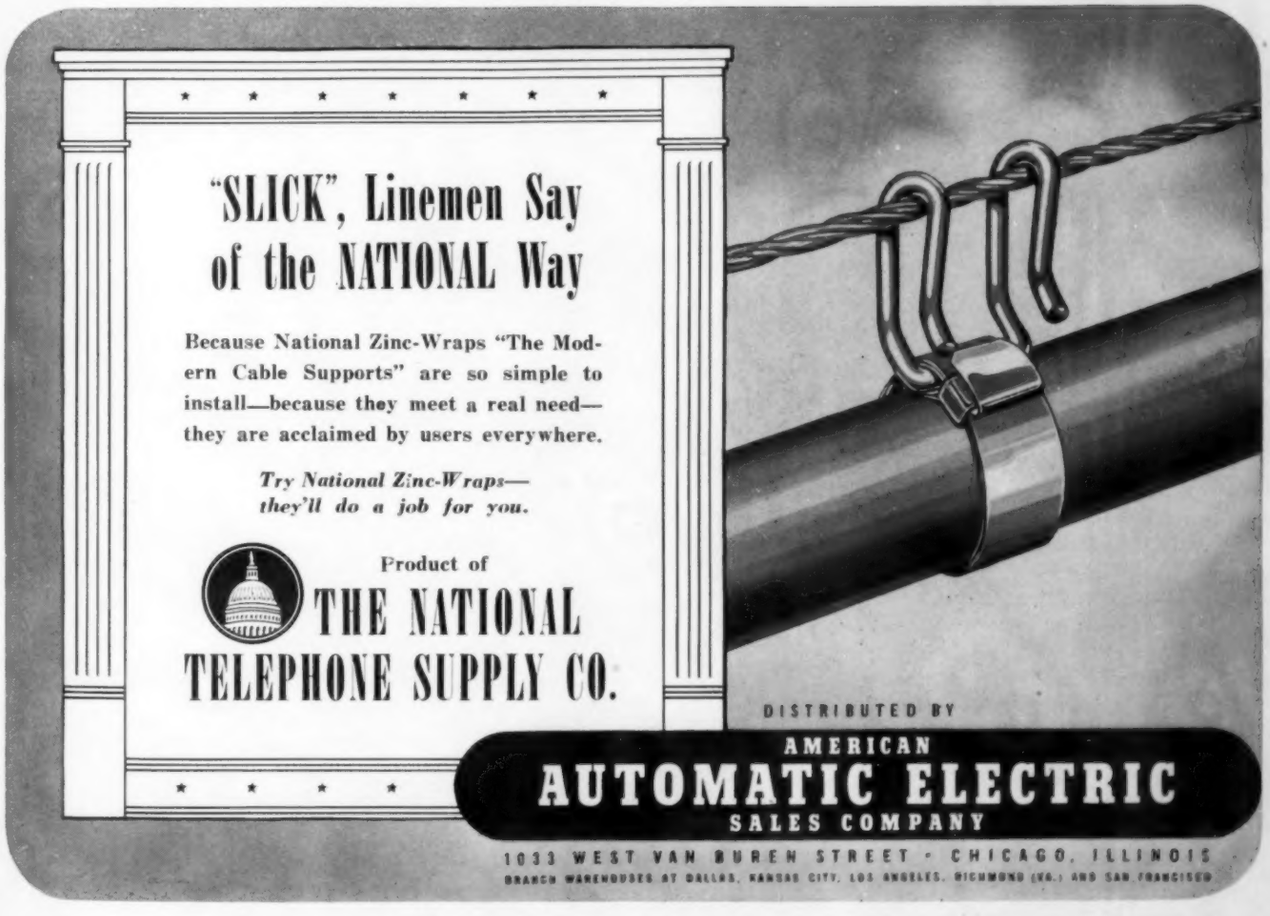
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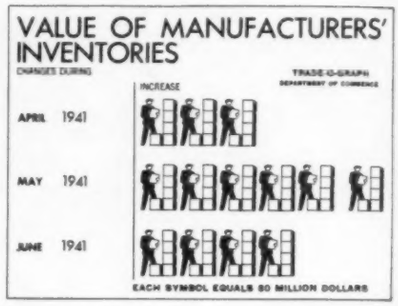
(Continued from page 18)

tions" and property on which the Bell Companies had collected an appreciable portion of their original investment so far as their own depreciation expense account is concerned is claimed to be almost as good as new when the companies are calculating their rate base." He declared that the FCC—State Commission cooperation "can bring order out of the present chaos of depreciation contradictions—with a tremendous saving to telephone users as a result."



A. T. & T. Vice President Harrison Directs All OPM Production Activities

ONE of the outstanding communications engineers of the world, William H. Harrison, Vice President and Chief Engineer of the American Telephone and Telegraph Co., who has been engaged in important posts with the National Defense program since July, 1940, was elevated to the directorship of the Production Division of the Office of Production Management in the recent reorganization of OPM. One of the outstanding communications engineers in the world, Mr. Harrison succeeded John D. Biggers. His designation was a tribute to the notable and successful work which the A. T. & T. executive has performed in directing the construction of hundreds of Army and Navy bases and defense plants and setting into motion the tremendous Naval and merchant marine shipbuilding program.

It was understood that both the White House and OPM Director General William S. Knudsen sought the services of Mr. Harrison in his new post of supervising the production of all finished defense and armament materials and equipment, covering the very wide range of ordnance, munitions, aircraft, tanks, food, clothing, medical and other supplies for the Army and Navy and Lend-Lease aid to Great Britain, Russia, China and other democracies. Mr. Harrison will have under his direction the greatest production program in world history as next year's defense expenditures and supply activities will be increased to at least double the present program.

Ever since he came to Washington on leave from his A. T. & T. position, Mr. Harrison has made one of the most outstanding reputations of any industralist in the defense organization. He has won the complete admiration and confidence of the top-ranking Army and Navy officials and is also very popular among the New Deal leadership. The A. T. & T. Vice President joined the defense program when Mr. Knudsen named him Director of Construction with the National Defense Advisory Commission. When OPM was created he became, on Jan. 18, 1941, Chief of Construction, Shipbuilding and Production of Supplies other than ordnance and aircraft.

Settlement Reached on Western Electric-Installers' Union Negotiations

AS was anticipated, an amicable settlement of the controversies between the Western Electric Co. and the Association of Communications Equipment Workers, the independent union for that company's installers, was reached after lengthy negotiations with a panel of Federal Conciliators of the U. S. Department of Labor. The agreement ended the widely publicized threats of a nationwide telephone stoppage which the ACEW had claimed might occur if the 9,000 Western Electric installers had gone out on strike.

After 61 hours of almost continuous negotiations, the Western Electric and the ACEW reached a settlement which included a blanket 6 cent an hour wage increase, recognition of the union as the sole collective bargaining agency for the employees concerned, and agreement on seniority rights and the principle of arbitration.

See our October Convention Number for Exhibit News

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Because National Zinc-Wraps "The Modern Cable Supports" are so simple to install—because they meet a real need—they are acclaimed by users everywhere.

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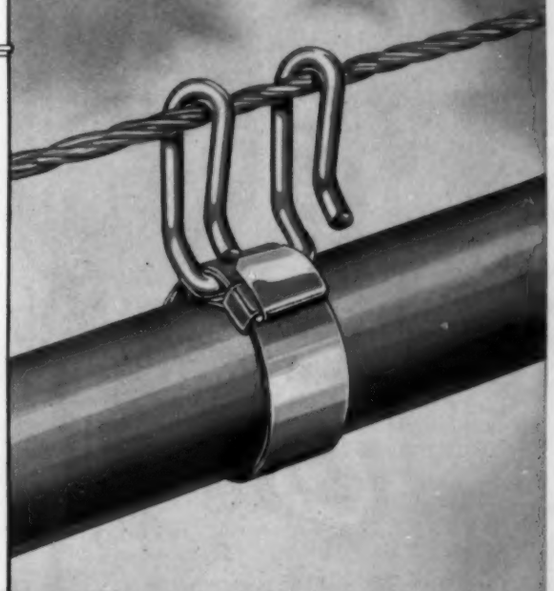

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Conducted by B. C. BURDEN, Technical Editor

Line AND Desk

Cable Data and Construction

Q. How frequently should aerial cable be bonded to the messenger?

A. Standard practice is to bond at the beginning and end of a cable run and at every tenth intermediate pole.

Q. Is ordinary parafine suitable for boiling out pulp insulated cable?

A. At temperatures above 75° F. ordinary parafine is satisfactory but at lower temperatures a special oil must be added, the amount ranging from 15% to 50% for temperatures from 75° to -10°. The oil makes the insulation work better and prevents it becoming brittle.

Q. What is meant by the term multiple unit cable?

A. This term refers to a new cable makeup in which the pairs are arranged in unit groups rather than all being stranded spirally around a central core.

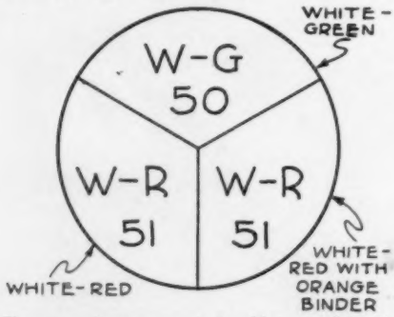

Fig. 1 — Arrangement in New Multi-unit Cables.

Fig. 1 illustrates the arrangement in a 150 pair multiple unit cable. The new method simplifies the identification of pairs as well as the splicing operation.

Q. What form of cable terminal should be used in buildings where moisture is not a problem?

A. It is common practice to use a 20 or 25 pair bakelite connecting block and fanning strip housed in a wooden or metal box as shown in Fig. 1. If the building cable is paper insulated either a S & C tip cable should be spliced on near the cable terminal, or if care is taken the paper insulated cable can be terminated without a tip cable. The cable form should be thoroughly boiled out and shellaced.

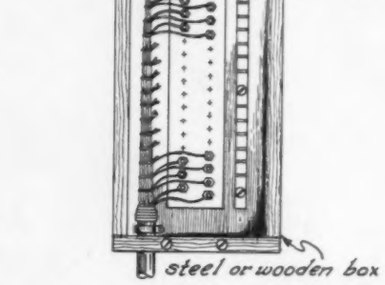

Fig. 1 — Method of Terminating Building Cable.

Q. What is the purpose of the capacity unbalance sets which are used on quadded cables?

A. Capacity unbalance sets are used on new quadded cable construction to measure the capacity unbalance existing between the four wires of a quad. Measurements are taken at splice points before the cable is spliced together and then the unbalances in the cable extending in one direction are used to neutralize unbalances in the cable extending in the opposite direction.

Transmission and Crosstalk

Q. How much transmission loss does the average repeating coil cause when introduced in the line circuit?

A. The loss will depend on the quality of the coil used. Modern coils should not add more than 0.75 db loss. Some of the older coils were relatively inefficient and had losses as high as 3 db.

Q. Why will a ½ m.f. non-ring through condenser pass voice frequency (1000 cycle) currents but not 20 cycle ringing currents?

A. A ½ m.f. condenser offers only 323 ohms impedance to 1000 cycle currents but 15,900 ohms to 20 cycle ringing currents.

Miscellaneous

Q. How far from the floor should the transmitter of a wall telephone be located?

A. The center of the transmitter should be located 56 inches above floor unless the subscriber requests otherwise.

Q. How close to a foundation wall should a ground rod be placed?

A. Because of moisture conditions it is desireable to keep the ground rod at least 12 inches out from the wall.

Q. How should inside wire be spliced and is soldered joints necessary?

A. Modern practice is to use copper splicing sleeves either of the double tube or compression type. Soldering is not necessary when sleeves are used.

Q. Where a 5 pair pole type protector is used to protect cable at the junction of open wire and cable, how should the protector be connected?

A. The ground strip of the protector must be connected to the cable sheath **or messenger** if maximum protection is to be obtained. It may also be connected to earth but this is less important than connection to the cable sheath.

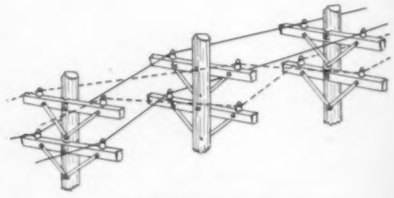

Fig. 1—Type Two Phantom Transposition on Phantom Group 5-6, 15-16.

Q. Please furnish us with a sketch showing how to make a phantom transposition in pairs 5-6 and 15-16.

A. Fig. 1 illustrates how pairs 5-6, 15-16 are phantom transposed. A type 2 transposition is shown.

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This is the *HEART* of
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A Story of RELAYDIAL

Stromberg-Carlson produces RELAYDIAL Systems for central offices, private branch exchanges, isolated community exchanges, inter-connected community exchanges, and as satellites for larger exchanges.

While there are many new and improved features employed in these systems that promote greater efficiency, probably none is of greater importance than the 500 Relay which is used as the switching device. In this Relay, the number of mechanical parts has been reduced to a minimum, meaning longer free-from-trouble service.

Of particular importance is the added reliability of performance gained by having each contact made through twin contact points mounted on a very flexible forked spring and rubbing against flat contact surfaces mounted on a fixed spring. This construction gives the contact points maximum wiping action for any movement of the armature.

Stromberg-Carlson engineers will gladly furnish you with detailed data regarding Stromberg-Carlson RELAYDIAL Systems to meet your own requirements.

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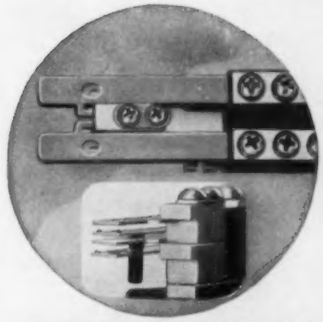
These are the reasons why twin contacts make the No. 500 Relay so reliable and dependable.

SPLIT ACTUATING SPRINGS

The probability of contact failure is lessened to the vanishing point with twin contacts operating in conjunction with the forked or split construction found in the lighter flexible actuating spring. The armature movement being transmitted directly to the flexible moving spring provides the "wipe" and "follow" which further insures dependability.

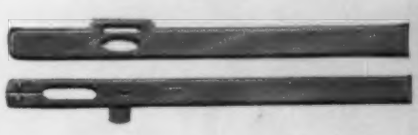


STOP BLOCKS WHICH PRESERVE SPRING ALIGNMENT

Rugged stop blocks made of molded insulating material and held in place by two No. 4 x 40 Phillip Head Screws, definitely maintain contact spacing between springs and aid in establishing spring pressures.

PRECIOUS METAL TWIN CONTACTS

Each spring is equipped with two contact points of precious metal. This design reduces resistance (about half), nearly doubles carrying capacity, and provides increased reliability of electrical contacts. Contact points are located at the end of the springs and no intervening material obstructs the view for ready inspection.



Conducted by
R. A. Clark, Jr.

Cross-Talk Theory

This article is the first of a series presenting the theory of cross-talk for the practical engineer. Two or more carrier systems on a pole line necessitate careful cross-talk investigation and it is the purpose of these articles to give a background for practical studies.

THE increased use of carrier telephone and telegraph systems has necessitated careful study of high frequency cross-talk where more than one carrier system is routed over a pole line. In this and the following articles I will try and present some basic information and data which will be of assistance in determining the most economical solution of such problems. We will consider first the basic principles and then discuss transposition schemes suitable for carrier systems.

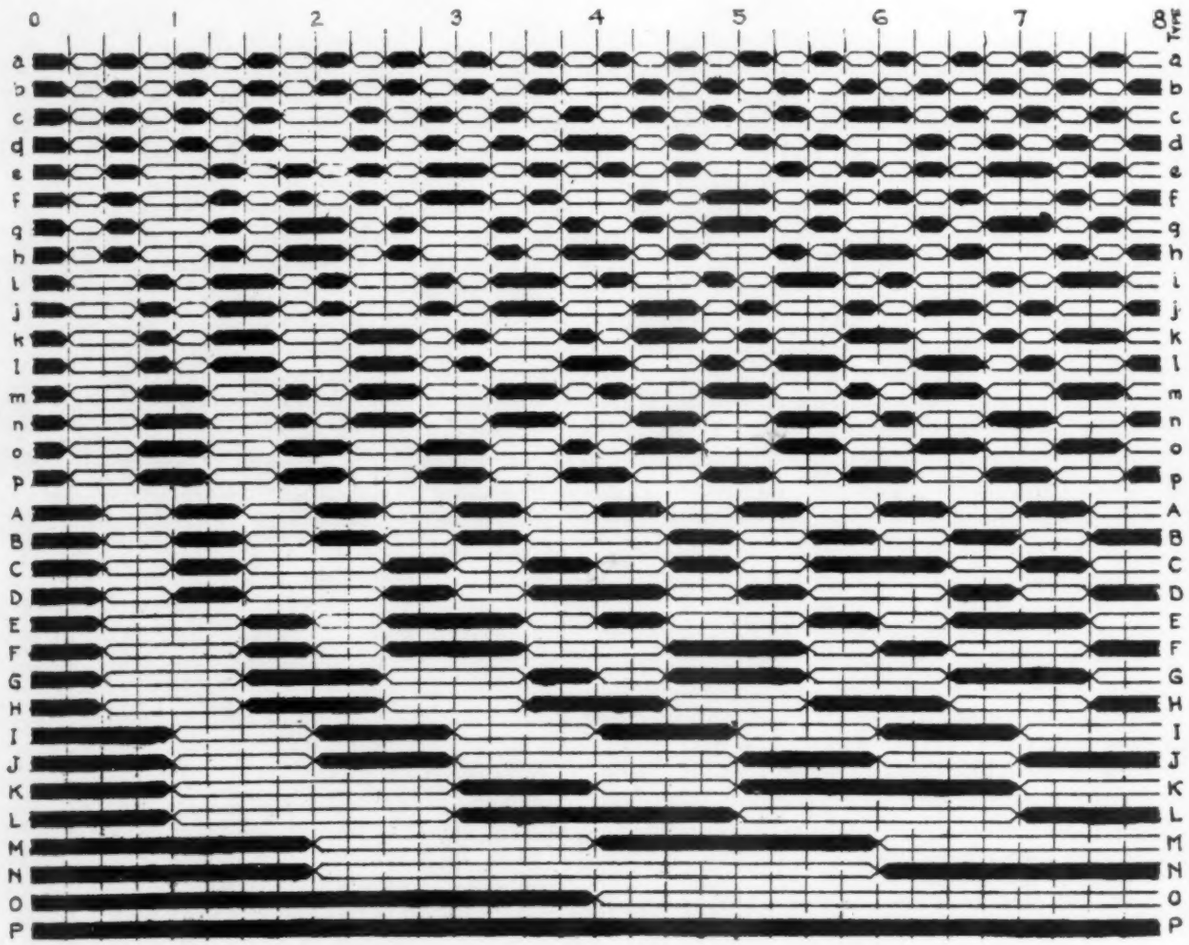
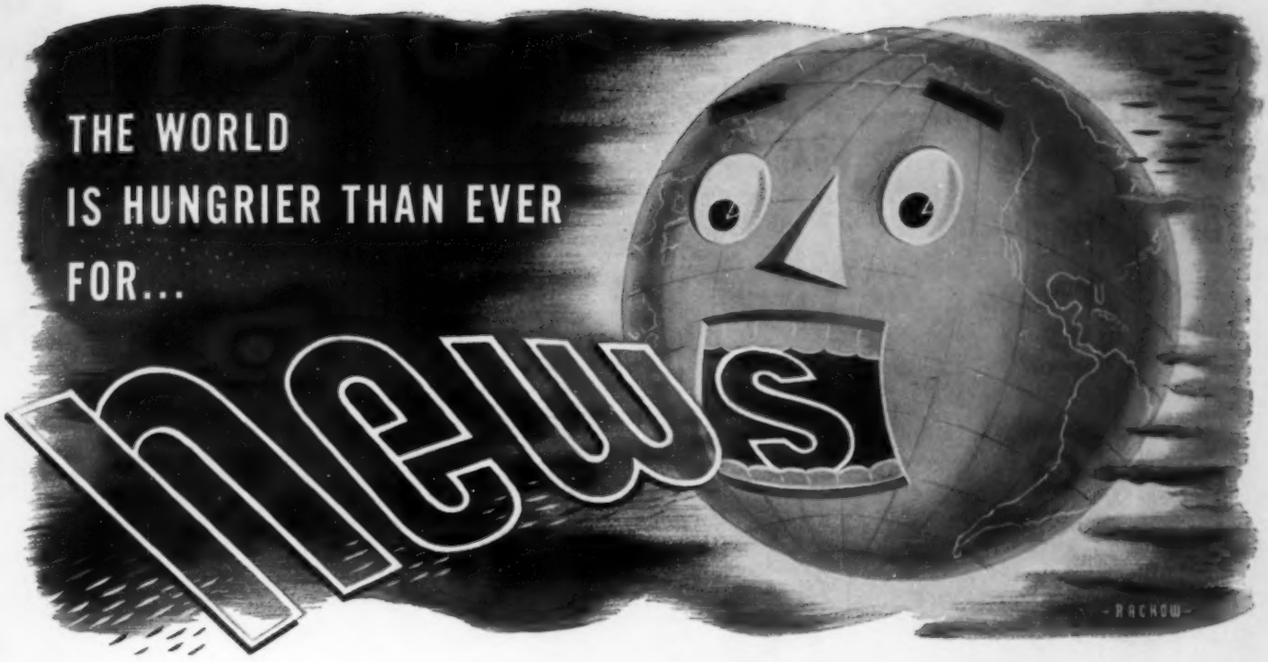


Fig. 1—Fundamental Types of Transpositions for 32 points per section.

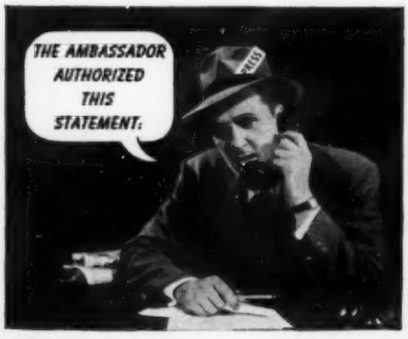


How this appetite for news is fed

What happened in Europe today? What did Congress do? Who won the golf title? And, nearer home, will it rain this week-end?

We want fast answers—and we get them through newspaper, newsreel and newscast. Do you know that these purveyors of news gather it largely on equipment produced by one organization?

* * *



The newspaper reporter's right arm is the telephone —made by Western Electric

Using the long arm of the telephone, the reporter can reach out to thousands of inaccessible spots, scoop up the news and bring it to his own desk. When he is in the field, telephones everywhere put him in instant touch with his paper.

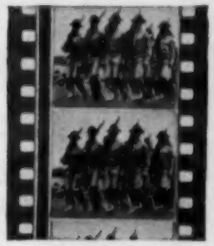
News while it's fresh is flashed over Western Electric Teletype machines

The great press associations send out thousands of words every day to papers all over the country. These stories go by Teletype machines which make for speed and accuracy. And they travel over telephone wires—another Western Electric product.

Western Electric made the first commercial telephoto equipment

Many newspapers publish photographs which come over the telephone wires—and by means of sending and receiving apparatus which Western Electric made. Here illustrated is an operator about to transmit a picture to a group of newspapers.

Many newsreels are recorded and reproduced by Western Electric Sound System



The sound newsreel and, indeed, the talking picture itself were made possible by the pioneering work of Bell Telephone Laboratories and Western Electric.

Most radio news travels over Western Electric telephone wires

Many radio stations broadcast over Western Electric apparatus. Moreover, network programs come to your local station over telephone lines and through control centers equipped by Western Electric.

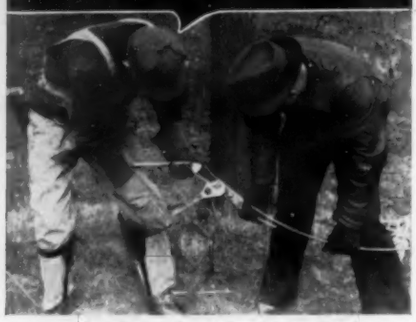
* * *

Though it plays these varied parts in your daily life, this Company is of greatest importance to you in its primary role—that of source of supply to the Bell System. As such, it is the telephone users' assurance of equipment high in quality, low in cost, dependable in operation.

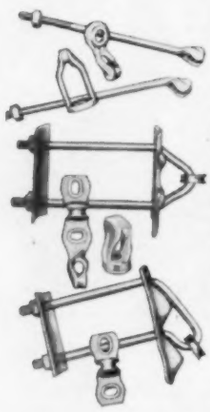
Western Electric

. . . is back of your Bell Telephone service

"This is a cinch! Half the job is done on the ground . . .



. . with THIMBLEYE guying fixtures."



Guy attachment is much simpler and easier when Chance Thimbleye guy fixtures are used. Guys may be made up on the ground ready to mount on the pole. Attaching the guy to the pole is then much quicker and easier than the old wrap around method. The hazard of loose flying ends of cable is eliminated and several feet of strand are saved on each installation.

GET FULL GUY STRENGTH

The Chance drop-forged Thimbleye permits guy strand to be pulled through or wrapped around the thimbleye groove without kinking, bending or breaking. The strand retains its full cylindrical form and is not weakened by distorted or broken strands. Compare the smooth contour of the strand in the thimbleye with the unnatural bends and strand separations in the ordinary eye.

Thimbleye guy fixtures make it safer to depend on guy strand to carry its recommended load.

Chance Thimbleye guy fixtures may be used individually or in a variety of combinations.

Manufactured and distributed by these licensees—

Copperweld Steel Co.....Glassport, Pa.
Electrical Mfg. Co.....Battle Creek, Mich.
Hubbard and Company.....Pittsburgh, Pa.
Joslyn Mfg. & Supply Co.....Chicago, Ill.
Kortick Mfg. Co.....San Francisco, Cal.
Line Material Co.....Milwaukee, Pa.
Oliver Iron & Steel Co.....Pittsburgh, Pa.
Seyler Mfg. Co.....Pittsburgh, Pa.
Utilities Service Co.....Allentown, Pa.

A·B·CHANCE CO. · CENTRALIA MISSOURI

Owing to the high cost of installing a complete carrier transposition scheme it is often possible where only two or three systems are involved to install special transpositions at a nominal cost which will adequately take care of the problem.

In some cases it may be merely necessary to choose proper pairs on the lead; in others a few transpositions on the carrier circuits may be all that is necessary. A little investigation will often save a large investment as the standard carrier transposition schemes are relatively expensive.

In the modern transposition scheme all circuits are transposed in accordance with certain fundamental types. Each type has for convenience been coded using large and small letters of the alphabet. Fig. 1 shows the fundamental types for 32 transposition poles. This includes the standard voice frequency transposition system. With this scheme every circuit is balanced against every other circuit over the entire section. It should be noted that some circuits have a better balance than others and for this reason, a careful study of the transposition scheme may enable one to choose certain pairs which will be very well balanced against each other. For example, type A has a very high degree of balance against type N. At the other extreme, type A does not have a high balance against type B.

A quick check of balance can be made by first determining the type of transposition scheme for each pair involved and then referring to Fig. 1 from which the balance can be seen quite merely well by inspection. For example, suppose we desire to investigate the cross-talk between pairs 1-2 and 19-20 in an E section. We find that pair 1-2 is type O and pair 19-20 type B. A comparison of these two types on Fig. 1 shows that there is a very high degree of balance throughout the entire section as type O is fully balanced against type B at every second transposition pole. We would therefore conclude that there would be very little cross-talk between these two pairs especially considering the fact that they are on opposite sides of the pole. The position of the wires on the lead plays an important part in cross-talk and in the following articles a table will be presented showing the cross-talk between pairs on various pin positions.

Personals from the Field

(Continued from page 23)

his ability in first aid by saving the life of a motorist overcome by monoxide gas. Found on a country road by Mr. Ryan, with all appearance of death before artificial respiration was started, the patient, a transient, was then removed to a hospital where he made a rapid recovery.

●

B. H. Piepmeier, president of the Tennessee Independent Telephone Association, reports nice attendance at the recent district meeting held by his association at Red Boilings Springs August 29. A full day meeting of business broken by a chicken dinner at noontime made this meeting of much value to all in attendance. Heard in discussion were: **Mr. Piepmeier, W. G. Snapp, W. L. Gardner, R. D. McDuffie, D. B. Corman and S. B. Dibble.** Mr. Dibble, president of the Kentucky association and **H. S. Poage,** secretary-treasurer of the Kentucky Association were visitors.

●

Frank Maris of Kingman and **L. J. Maris** of Attica, Ind., brothers, have petitioned the Indiana Public Service Commission to sell the Kingman Telephone Company. The Kingman company operates exchanges at Kingman, Cates and Silverwood. The purchaser is the recently organized Wabash Valley Utilities Corp. of Greenfield. Value placed on property: $15,000.

●

Lt. Col. F. L. Stanley, plant extension engineer of the Indiana Bell, has been ordered to Washington to act as assistant to **Lt. Col. J. C. Grable** who is head of the Plant and Traffic Division of the Signal Corps. Col. Stanley is the son of the former manager of the Ladoga (Ind.) Telephone Company and has been with the Indiana Bell for almost 20 years.

●

Doyle McAfee, formerly manager of the Slyvia, Kas. exchange of the Western Light and Power Co. is now with the Stanolind Pipe Line Co. at High Island Texas.

●

Hugh Barnhart, president of the Rochester (Ind.) Telephone Company, has been appointed Director of the Department of Conservation of Indiana. At the time of his appointment he was Ex-

cise Administrator of the Alcoholic Beverages Division.

●

Bert Fisher, until recently local manager at White Water, Kas., has been transferred to Waverly to serve as manager of that exchange of the Central Kansas Telephone Company. The White Water exchange was recently traded to the Southwestern Bell.

●

E. A. Tull, boss man at the Lapel (Ind.) Telephone Company has ordered new central office equipment for his exchange which with the conversion will be modern in every respect.

●

Leslie Gritten is the wide awake secretary-treasurer of the Oregon Independent Telephone Association who writes their interesting "News and Views." It's a real pleasure to read it as his style makes you feel he is right across the desk from you.

●

We are looking forward to seeing you **George Blake,** Santa Monica, Calif. at the National Convention here in Chicago on October 14 thru the 17th.

●

John W. Holt, manager of the Stillwell (Okla.) Telephone Company will sponsor the District Meeting scheduled for his city by the Oklahoma Telephone Association on Sept. 26. Of course our old friend **H. W. (Hube) Hubenthal** will be in attendance.

John F. Murphy, 76, a phone man for 51 years and until his retirement in 1931, an employee of the New Jersey Bell Telephone Company, died in Newark, N. J. on August 17. At his retirement he was the oldest employee of the New Jersey Bell and received a diamond and gold emblem for his service record.

●

S. B. Green, general superintendent of the Illinois Valley Telephone Company, is now in Sumter, S. Car. where he will direct operation of the South Carolina Continental Telephone Company during a three-month leave of absence granted **L. E. Winget,** general manager of that property that he might take a long rest. According to press reports Mr. Green will return to Illinois after Mr. Winget returns.

●

W. M. Campbell became owner operator of the Westover (Tex.) Telephone Company last month. He purchased from **G. L. Humphrey** who owned the property for many years.

●

We know three people who should show a big improvement in their golf scores because we saw them at the recent $12,000 open golf tournament in Chicago. From now on **Ray Krueger,** Kellogg, **Geo. Rodomer,** Reliable and **Dan McNulty,** Telephone Repair should give strokes to all competitors.

Courtesy Associated Circle—Lee Gordon

FACTS and FIGURES that should interest YOU!

No. 11

Some exchanges are more than 27% equipped with GRAY No. 11 Pay Stations.

While this percentage is above average, the records show a great many companies that are from 10% to 20% pay station equipped.

The interesting part is that these pay stations not only pay their own way, but also return a substantial profit.

Check your territory today and make sure you are not passing up any opportunities for increasing your own revenues.

AUTHORIZED AGENTS:
American Automatic Electric Sales Co.
Graybar Electric Company
Kellogg Switchboard & Supply Company
Leich Sales Corporation
The North Electric Mfg. Company
Stromberg-Carlson Telephone Manufacturing Company

IN CANADA:
Canadian Telephones & Supplies, Limited
Northern Electric Co., Limited.

the **GRAY MFG. CO.**

Wire Chief's Training Course

(Continued from page 22)

Table No. 2—Standard Vertical Clearance Between Power and Telephone Lines.

Nature of Wires Crossed Over	0 - 750 Volts		750 Volts to 7500 Volts	7500 to 50,000 Volts
	Line Wires	Service Drops		
Telephone cables, guys, open wire, and drop wires	4*	2	4	6**

* A clearance of 2 feet may be permitted where the supply conductor is above the communication conductor, provided the crossing is not within six feet from any pole concerned in the crossing and the voltage to ground does not exceed 300 volts.

** For voltages in excess of 50,000 add 0.5 inch clearance for each 1,000 volts excess above 50,000 volts.

Table No. 2—Standard vertical clearance between power and telephone lines.

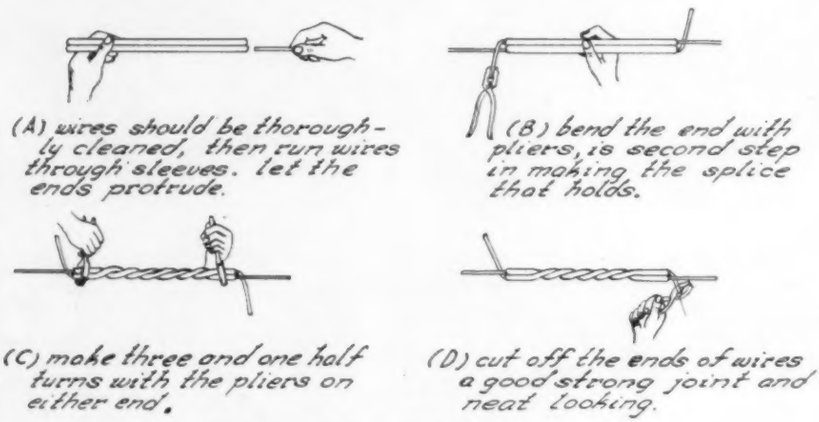

(A) wires should be thoroughly cleaned, then run wires through sleeves. let the ends protrude.
(B) bend the end with pliers, is second step in making the splice that holds.
(C) make three and one half turns with the pliers on either end.
(D) cut off the ends of wires a good strong joint and neat looking.

Fig. 3—Four Steps in Splicing Wire.

The Copperweld wire (size No. 102) offers long life, good transmission, and high strength. It is of course higher in first cost than galvanized iron or steel wire, hence has not been as extensively used for ordinary rural lines.

A new Copperweld wire (known as 14-40) that has about the same electrical and strength characteristics as ordinary BB galvanized iron wire and yet is designed to sell at approximately the same price is now available. The new wire is the same diameter as No. 14 A.W.G. (.064"). Its light weight (only 60 lbs. per mile) makes it somewhat easier to handle than iron wire. The mechanical and electrical characteristics of the several types of wire are given in table No. 3.

Hard drawn copper wire is used principally on toll lines. No. 12-NBS (.104) is most widely used. Some of the most important long haul circuits use No. 10-NBS and No. 8-BWG (0.128 and 0.165). The cost of copper wire makes its use impractical for rural lines.

Fig. 4 — Cut-away View of Rolled Type Splice. (Courtesy James R. Kearney Corp.) Above: Before Rolling—Note the spiral corrugation on the outer surface of the sleeve. Note also how the conductors abut at the center stop within the sleeve—no overlap. Below: After Rolling—Note how the outer corrugation of the sleeve have been rolled in, causing the conductors to conform to the sleeve in a waved, smoothed-crimp manner to make a light, positive joint.

Insulator Data

Different types of insulators are used for the various classes of open wire lines. Ordinary exchange and rural lines should use either **pony** or **exchange type** insulators. For minor toll lines **single petticoat toll insulators** are standard and for important long haul toll circuits **double petticoat toll insulators** are preferred. The transcontinental circuits of the Bell System, as well as some long haul circuits that carry multi-channel carriers, are equipped with special **Pyrex type** insulators which have exceptionally low dielectric losses, hence are better suited to carrier frequencies than the ordinary glass insulators. The several types of insulators are shown in Figure 1.

Fig. 5—Tool for making compression Splice of Rolled Type. (Courtesy James R. Kearney Corp.)

The toll insulators differ from the exchange or pony type mainly in their heavier construction and longer leakage paths. If pony or exchange type insulators were used on long toll lines the wet weather leakage would be abnormally high due to the short leakage path of these insulators as compared to toll insulators.

In addition to glass insulators as shown in Figure 1, some use is made of porcelain type strain insulators as dead end supports on long span steel wire construction.

Fig. 6—Sleeve for Use with Nicopress Method. (Courtesy National Telephone Supply Co.)

Wire Splicing Methods

A very important phase of open wire construction work is wire splicing. Conductors should be spliced so as to be mechanically and electrically as good as the wire itself.

In the early days splices were generally of the "hand made type." When properly made such splices gave good results but handmade splices in general proved very troublesome and were particularly bad from a transmission and signalling standpoint due to their tendency to develop resistance.

Although handmade splices are no longer used, the method of making a splice of this type should be understood as one may be occasionally called on to splice line conductors when materials are not on hand to make an approved type splice.

There are several different ways in which hand splices can be made but the Western Union type shown in Fig-

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HANDBOOK TABLES

General

By B. C. Burden

Date—September 15, 1941

Subject—CONDENSER REACTANCE

The retarding effect which a condenser offers to the flow of alternating current is known as *capacity reactance* and is expressed in ohms. It is important that a telephone man appreciate the effect a condenser has on voice and ringing currents. For example, a 0.5 mf condenser when placed in the receiver of a party line telephone offers an impedance of 15,924 ohms to 20 cycle ringing current but only 318 ohms to 1000 cycle voice currents, hence effectively bars the ringing current but allows the voice currents to pass without appreciable loss.

The table below gives the reactance in ohms of various size condensers at various frequencies. The table is based on the relationship:

$$Xc = \frac{1}{2\pi fc}$$

Where: Xc—reactance in ohms
f —frequency in cycles
c —capacity in farads

CAPACITATIVE REACTANCE FOR VARIOUS FREQUENCIES

Capacity in m.f.ds.	FREQUENCY (in cycles)					
	60	1000	10,000	100,000	500,000	1,000,000
.0001	26,539,252	1,592,356	159,235	15,923	3,184	1,592
.00025	10,615,600	636,942	63,694	6,370	1,274	637
.0005	5,307,850	318,489	31,849	3,185	637	318
.001	2,653,925	159,236	15,924	1,592	318	159
.005	530,785	31,849	3,185	318	64	32
.010	265,393	15,923	1,592	159	32	16
.015	176,929	9,952	995	99	21	10
.020	132,697	7,961	796	79	16	8
.050	53,078	3,185	318	32	6	3
0.100	26,539	1,592	159	16	3	1.6
0.250	10,616	637	64	6	1	0.6
0.500	5,308	318	32	3	0.64	0.3
1.000	2,654	159	16	2	0.32	0.2
2.000	1,327	80	8	0.8	0.16	0.08
4.000	664	40	4	0.4	0.08	0.04
6.000	442	26	3	0.3	0.05	0.03
8.000	332	20	2	0.2	0.04	0.02
10.000	265	16	1	0.1	0.03	0.01

Table No. 3—Mechanical and Electrical Characteristics of Open Wire Conductors

Type Wire	Actual Diam. Inches	Breaking Load	Weight Per Mile	Resistance Ohms per Mile	Loss in DB per Mile
Copperweld					
#14 AWG (CW)	.061″	400	60 lbs.	34.0	0.30
#10 AWG (CW)	.102″	1130	152 lbs.	13.44	0.156
#8 AWG (CW)	.128″	1660	242 lbs.	8.45	0.111
Iron & Steel					
#12 BWG (BB)	.109″	476	170 lbs.	34.12	0.30
#12 BWG (85)	.109″	793	170 lbs.	34.12	0.30
#12 BWG (135)	.109″	1213	170 lbs.	38.23	0.30
Hard Drawn Copper					
#12 NBS (HD)	.104″	550	172 lbs.	5.06	.066
#10 NBS (HD)	.128″	830	261 lbs.	3.34	.046
#8 BWG (HD)	.165″	1326	435 lbs.	2.01	.030

Table No. 3—Mechancial and Electrical characteristics of open wire conductors.

ure 2 was most widely used when hand splicing was in vogue.

Virtually all telephone companies now use either the double tube sleeve or compression type splice. Either of these two splicing methods will give excellent results if reasonable care is taken in making the splice.

To properly make up a double tube sleeve splice, the two wire ends must first be burnished with special abrasive paper. Failure to remove the film of corrosion on the wire may result in a high resistance splice. The several steps in making a sleeve splice are shown in Figure 3.

Fig. 9—Special Repair Sleeve that eliminates necessity for cutting in section of wire. (Courtesy National Telephone Supply Co.)

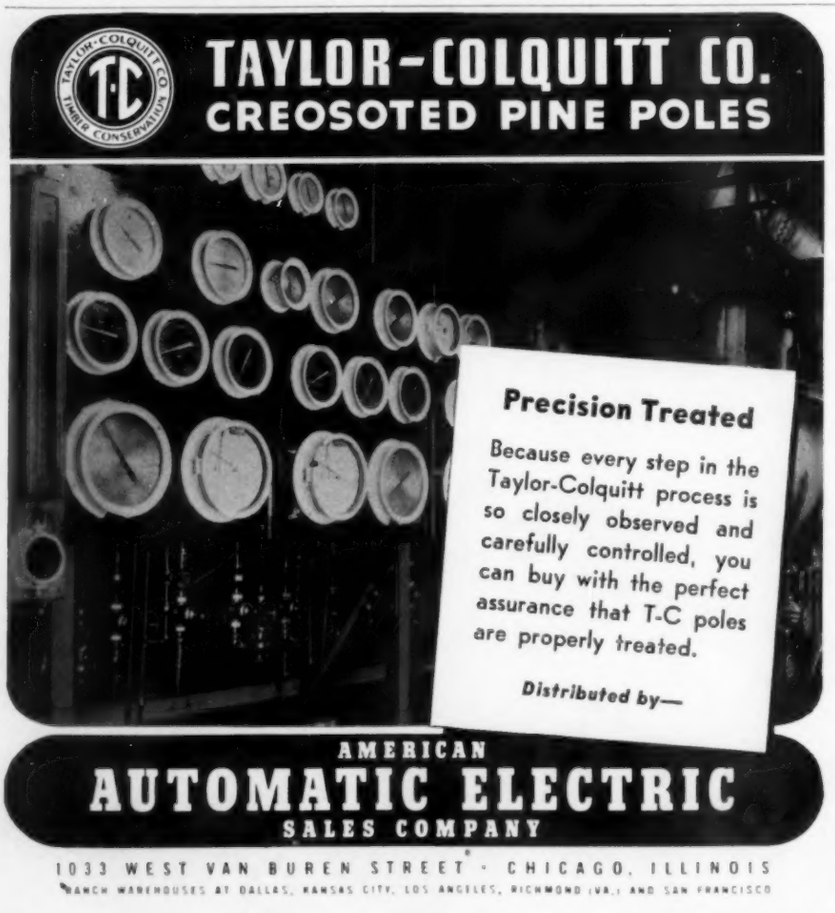
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Fig. 7—Nicopress Splicing Tool. (Courtesy National Telephone Supply Co.)

Compression Type Splices

THE compression type splicing method has become very popular since its introduction and is now widely used for the splicing of all types of open and drop wire.

Whereas the double tube splice depends for its holding power on the rigid twists placed in the two wire ends, the compression splice owes its exceptionally high strength to the compression bond between the interior of a straight sleeve and the inserted conductor.

A properly made compression sleeve in addition to being very strong mechanically is easy to make, it is virtually moisture tight, and it permits a line wire to be cut and spliced without affecting the existing sag of the wire.

There are two principal methods in use for making compression type splices, viz:

1. **The Rolled Sleeve method**
2. **The Straight Compression method**

In making compression sleeves of the rolled type, a special tool is required which when operated by a handle causes two rollers to exert sufficient pressure on the sleeve to bring it into extremely tight contact with the line wire. One type of tool also forms a series of waves or indentations which further aids in the holding power of the sleeve. Figure 4 shows a sleeve of the rolled type before and after rolling. The tool used in making this splice is shown in Figure 5.

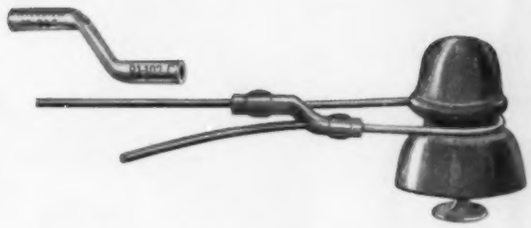


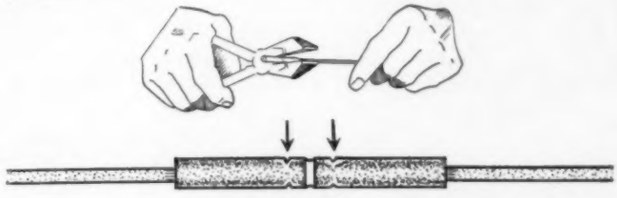
Fig. 10—Use of Offset Dead End Sleeve. (Courtesy National Telephone Supply Co.)

The straight compression type of splice requires the use of a sleeve like that shown in Figure 6. The sleeve is approximately 1-¾ inches long and is indented at its center so that the two wire ends can be easily inserted to the exact center of the sleeve.

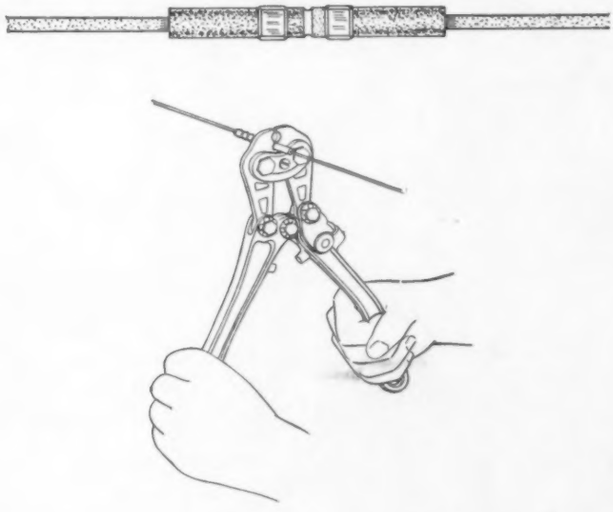
The sleeve is easily compressed on the wire using a compound lever tool like that shown in Figure 7. Four "bites" are required. The several steps in making a splice of this type are shown in Figure 8. It will be noted

(Please turn to page 47)

Pinch sleeve with cutting pliers at each side of center only enough to hold the wires from sliding out of position before splice is finished.



First make the two inside squeezes, closing the tool after each squeeze until the handle bumpers meet.



Then continue making squeezes until entire sleeve is compressed. There should be about 1/16″ space between squeezes. When the splice is completed it will look as pictured below.

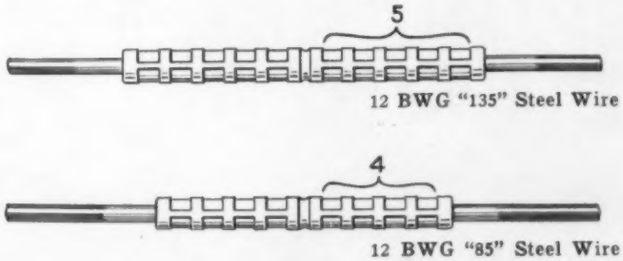


Fig. 8—Several Steps in Making a Compression Splice. (Courtesy National Telephone Supply Co.)

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Independent Telephone Companies

Continued from page 26

other toll center in the country was impracticable. For example, to connect two toll centers, only one group of circuits would be required; for direct connections for three toll centers, three groups; for five toll centers, 10 groups; for 10 toll centers, 45 group; for 100 toll centers, 4950 groups; for 1000 toll centers, nearly one-half million groups of toll circuits, and so on. This is indicated diagrammatically in Figure 3.

Another means of establishing toll connections between toll centers might be to provide direct circuit groups from each toll center to only its nearby toll centers, thus providing a network of circuits between all toll centers in the country. Under such an arrangement, a toll connection between distant toll centers could be built up by switches at each intervening toll center. Such a plan would be most impracticable, however, as it would, in many cases, require too many switches to permit establishing a speedy, efficient and economical service.

The General Toll Switching Plan

A GREAT deal of consideration was given to the broad general problem involved in the routing of calls and provision of adequate circuits, which finally led to the development of the fundamental layout of toll plant and routing of toll messages which today is known as the "General Toll Switching Plan." This plan was developed and adopted by the Bell System just before 1930.

It is of interest to note in passing that the Toll Switching Plan has been carefully studied by telephone engineers of the various European telephone organizations. In 1938 the International Telephone Consultative Committee (C.C.I.F.) at its meeting in Oslo, adopted rules and regulations along fundamentally the same lines for international connections within Europe.

The purpose of the plan is to provide systematically a basic plant layout designed for the highest practicable standards of service consistent with economy, including speed and accuracy.

AN important part of the development of the plan was the determination of proper transmission requirements for each connecting link between offices, such that any toll connection established in accordance with the plan would have satisfactory transmission efficiency. All technical measures of the quality of service, including speed, accuracy and transmission, indicate that the difficulty of giving satisfactory service increases rapidly with the number of intermediate switches. The General Toll Switching Plan, therefore, in addition to establishing standards of design that will provide satisfactory transmission, involves the layout of the toll circuits in such a man-

FIG. 5—THE GENERAL TOLL SWITCHING PLAN.

Regional centers and primary outlets in the United States and eastern Canada

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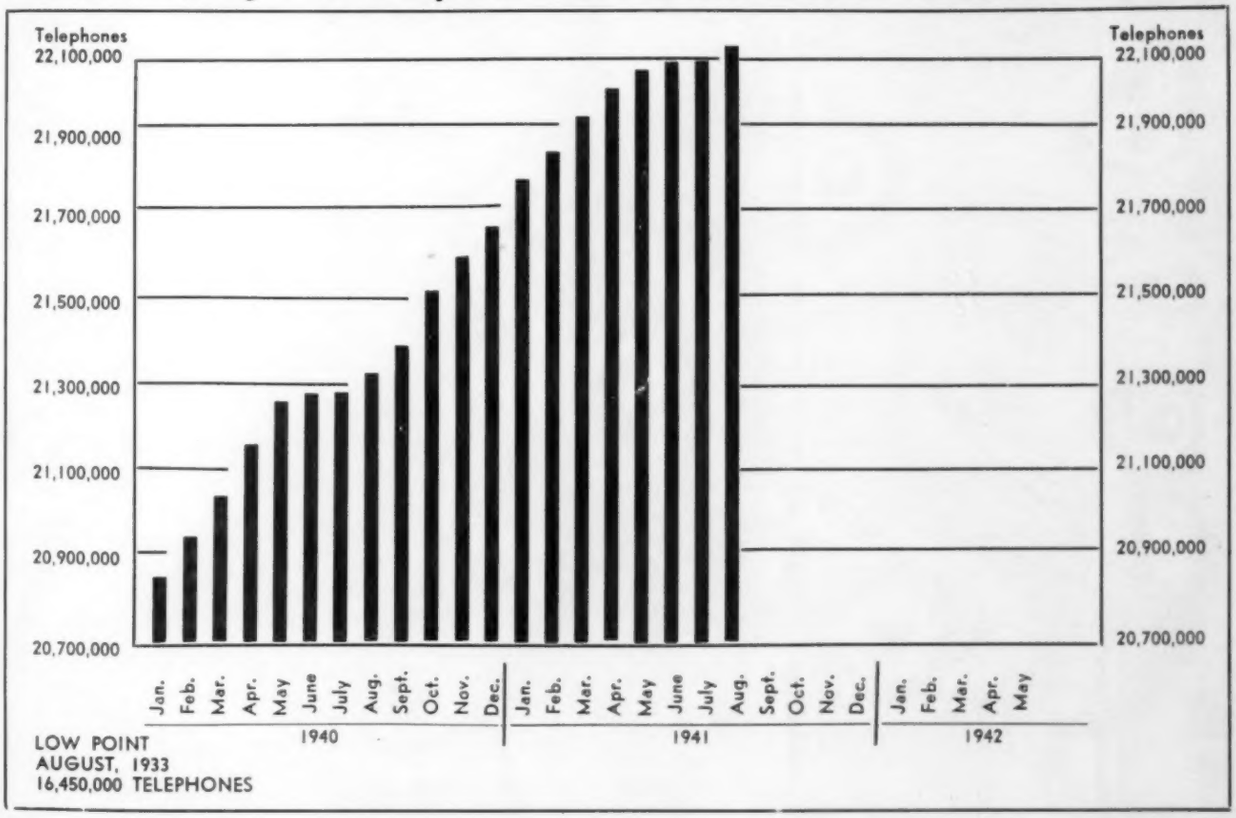

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ner as to reduce to a minimum the number of switches required to connect any two telephones. It is obvious that the provision of such circuits and routing of calls must be considered not only from the standpoint of traffic between any two particular points but also from the standpoint of the best over-all arrangement to provide a flexible and economical nation-wide system. The importance of this is emphasized by the rapid growth in the volume of long-haul traffic.

The general features of the Toll Switching Plan, as applied to a limited area, such as a State, required the selection of a minimum number of exchanges as toll centers. The selection was based on a careful study of the existing and probable future development of toll traffic within the area, and the ability of such exchanges to handle the toll operating work from the standpoint of facilities available, including lay-out of toll line plant and other factors. The selection of such exchanges also required a careful analysis in order to arrive at the best distribution of toll centers to handle the traffic speedily and economically. Within this same area a small number of the more important toll centers were selected as "primary outlets." In general, each toll center in the area is directly connected to at least one of these outlets, and each primary outlet is directly connected to the other primary outlets within the area. This makes it possible, as seen in Figure 4, to connect any two toll centers within that part of the area served by the same primary outlet with a maximum of one switch, and within the entire area with a maximum of two switches.

Choosing the Primary Outlets

THE selection of the primary outlets required not only a study of the particular area involved but also careful consideration of its relation to the nation-wide plan. A minimum number of primary outlets in a given area, capable of handling the traffic, is essential, since the number of circuit groups between the primary outlets increases appreciably as the number of primary outlets is increased. This point will be emphasized by again referring to Figure 3 but now considering each of the toll centers shown there as primary outlets. For example, ten groups of circuits are required to interconnect five primary outlets, and 21 groups are required to interconnect seven primary outlets.

The selection of certain exchanges as toll centers, and certain of these as primary outlets, was made from the standpoint of furnishing the highest practicable standards of service consistent with economy, and without regard to the ownership of the exchange involved. This resulted in the selection of about 2400

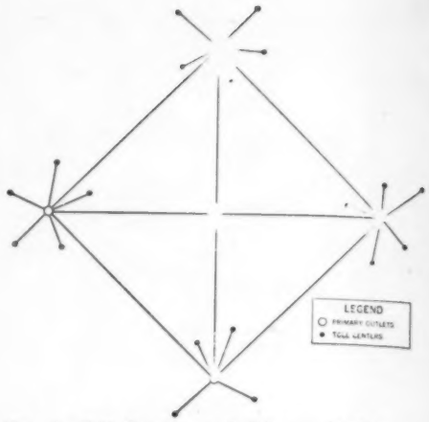

Fig. 4—Toll Centers and Primary Outlets. *This diagram shows the operation of the General Toll Switching Plan within a limited area*

toll centers in the United States, of which about 590 are connecting company exchanges and in the selection of about 140 of the toll centers as primary outlets of which nine are connecting company exchanges. The distribution of the primary outlets throughout the country is shown in Figure 5.

TO facilitate the handling of the longer haul business throughout the country, eight of the primary outlets located in the larger cities have been designated as "regional centers," which are also shown in Figure 5. The method of routing calls between exchanges in different regional areas is illustrated by Figure 6. The plan contemplates that each primary outlet will be connected with at least one regional center and with as many more as is practicable. If the traffic volumes increase sufficiently, then ultimately each regional center may be directly connected to every other regional center in the country. At the present time, through the circuits provided by the plan and other direct circuits, any one of the primary outlets can be connected to another primary outlet served by the same regional center with a maximum of one switch, or can be connected to any other primary outlet in the country with a maximum of two switches.

In addition to the routes provided by the plan for country-wide service, as illustrated in Figure 6, direct circuits or other routings are also provided where the volume of business is sufficient to make it desirable. Figure 7 illustrates such supplementary circuits by dashed lines. The use of such circuits is illustrated in the case of a call from a connecting company customer in Centerview, Missouri, to a telephone in the connecting company exchange at Gibsonville, North Carolina as shown in Figure 8.

The toll circuit groups between regional centers, and in some cases between primary outlets, frequently have a large number of circuits because of

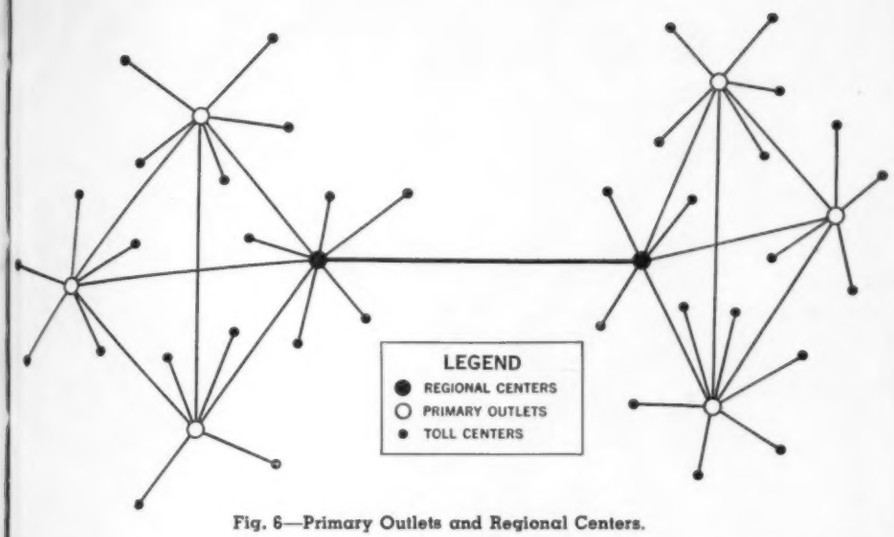

Fig. 6—Primary Outlets and Regional Centers.

Each primary outlet is directly connected with at least one of the country's eight regional centers

the large volumes of traffic involved. More calls per circuit can be operated over a large group of circuits than over a small group. For example, the available conversation time per circuit in a group of ten circuits is almost 22 per cent greater than the available conversation time per circuit in a group of two circuits. This demonstrates why it is frequently more efficient and economical to back-haul the routing of a toll call so that it may be routed via a large group of high grade circuits with good transmission and a fewer number of switches, as is the case shown in Figure 8. All of the circuits between regional centers are furnished by the Bell System. As a result of extensive development work in its Laboratories and through the provision of the highest grade of facilities throughout, it has been possible to reduce the transmission loss to a very low value. This is likewise generally true of the circuits between primary outlets and regional centers.

TOLL calls vary in length, from a few miles to across the continent. The charges for calls also vary, depending not only on distance and length of conversation but also on whether the call is person-to-person or station-to-station and whether week-day rates or night and Sunday rates apply. On calls to and from customers of connecting companies, these companies participate in the furnishing of the service and hence are entitled to a part of the revenue on each such message. The business relationships arising from the vast interchange of toll messages are described in traffic agreements executed between the connecting company and the Bell company with which it connects. The agreements define the responsibilities and duties of each of the companies, and specify the points of connection of the systems and the toll operating that is to be performed by each. The agreements also provide for the basis of division of revenues derived from the interchanged business.

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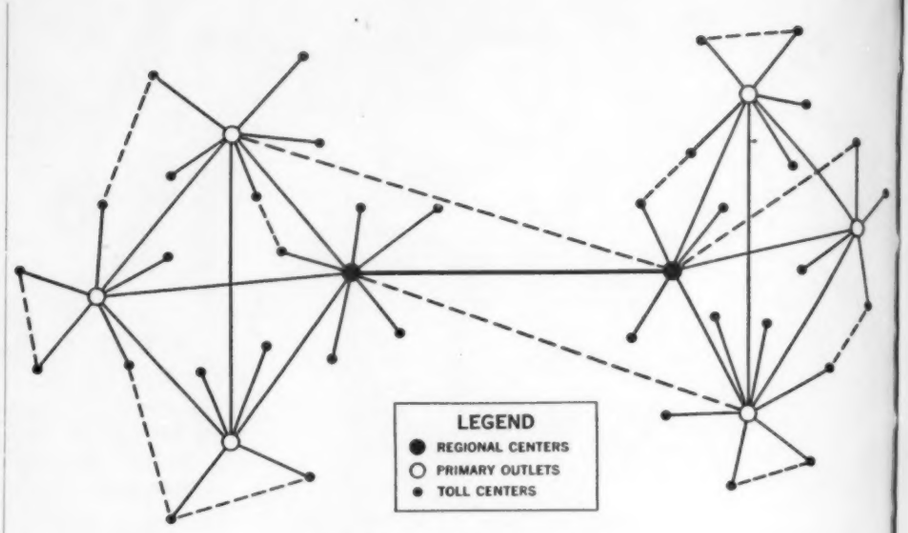

Fig. 7—Supplementary Circuits.

In addition to the basic circuits of the General Toll Switching Plan, supplementary circuits (shown by dashed lines) are established when the volume of traffic warrents

dreds of thousands of employees engaged in the industry. While the Bell System and the connecting companies throughout the country have for years worked together harmoniously to provide this country with the best telephone service in the world, they are now even more determined in their efforts to meet successfully the important problems that will face the industry during the coming days.

— END —

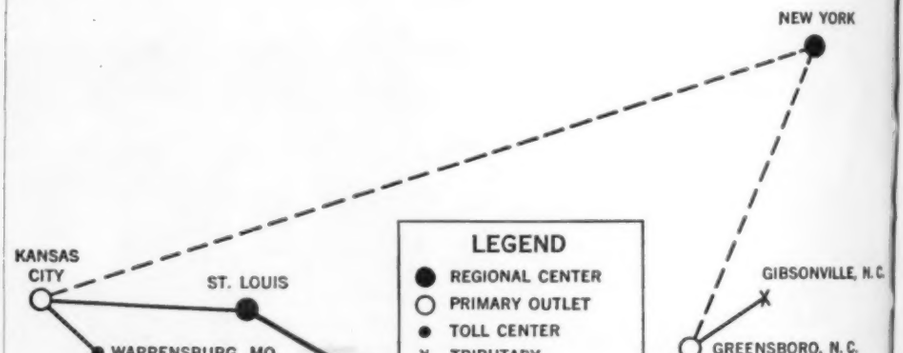

Fig. 8—Back-hauling a Call between Centerview and Gibsonville

The longer way 'round (dashed lines) is the shorter way home in this instance, requiring only two switches—at Kansas City and New York—between terminating toll centers. In the absence of these high-quality direct circuits between Kansas City-New York and New York-Greensboro, the call would be routed via the regional toll centers (solid lines) and would require switches at Kansas City, St. Louis, and Atlanta

Consider Telephone Co-op.

The community's growth makes more acute need of an organization to regulate telephone service, residents of the Youngs river district said at a group meeting recently. The telephone customers met with Professor Paul Carpenter of the Oregon State College in Astoria and discussed tentative plans for the formation of a co-operative telephone company.

The proposed co-operative, if formed, would take over lines now operated by a private concern.

Wire Chief's Training Course

(Continued from page 41)

Fig. 11—Use of Reducing Sleeve to Connect Drop Wire to Line Wire. (Courtesy National Telephone Supply Co.)

that the sleeve is pinched slightly with side cutting pliers after the wire ends are inserted in order to hold the line wires in position while the sleeve is being compressed.

The sleeves are sprayed on the inside with molten metal alloys that are harder than the metal of either sleeves or conductors, and this greatly increases the holding power of the sleeves.

Sleeves are available for all types of line wires.

The compression type splice has resulted in the development of special sleeves which are simple to use and at the same time improve open wire construction.

Figure 9 illustrates a repair sleeve that is exceptionally useful where an old splice is to be cut out and where there is insufficient slack to permit the line wire to be shortened. Sleeves of this type are available in lengths ranging from 7 to 10 inches.

Another sleeve that is becoming very popular is the offset deadend type shown in Figure 10. These sleeves make possible a neat and secure deadend for terminations at terminal poles or test points in open wire lines.

For use in connecting jumper wires to line wires at deadend points special reducing sleeves are available and are used as shown in Figure 11.

(QUESTIONS ON PAGE 48)

Pennsylvania Accounting Conference this Month

The Fall Accounting Conference of the Pennsylvania Independent Telephone Association will be held Sept. 22, 23, and 24 at the Culbertson Hills Golf and Country Club, Edinboro, Penn. according to an announcement received from E. H. Dillon, Chairman, Committee on Accounting and Auditing, of the Association.

The entire program is a well rounded conference on all problems of accounting and will be held in a very beautiful spot in Pennsylvania, including special tours to points of interest, dinners and dancing. The invitations received in our office lead us to urge attendance at the conference as the Erie crowd are doing their best to have both an instructive and enjoyable meeting.

Merge 3 Companies

At a meeting of the combined stockholders of three Wisconsin telephone companies, held late in August at Beloit, Wis., it was voted to merge the three companies into one concern to be known as the Belmont and Pleasant View Telephone company.

Companies merged were the Iowa-Lafayette Telephone company, Willow Springs Telephone company and the Belmont and Pleasant View Telephone company.

Stockholders voted the officers authority to bond the company for $25,000 and to raise the capitalization from $10,000 to $25,000.

Thirty stockholders were present at the meeting and 252 stockholders were represented by proxy.

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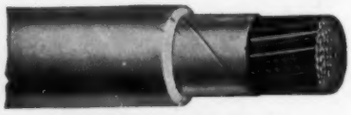

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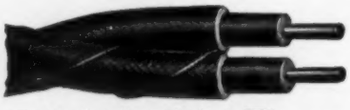

Twisted Pair Telephone Wire .... Rubber Insulated and Braided.

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Three State Convention Held in New Hampshire

The telephone Associations of Maine, New Hampshire and Vermont met in Annual convention at the Mt. Washington Hotel, Bretton Woods, N. H. for a 3-day session on September 9. The combined program provided a unique innovation in that each association had a meeting within a meeting. On the 1st day the Vermont association met followed by a banquet. At noon the 2nd day the Maine association convened and on the third day the New Hampshire association had their meeting.

For early arrivals there was an informal golf tournament. The first session was in the evening of the 9th when the Vermont association had their meeting. The morning of September 10 started with President J. Elmer Draper of the New Hampshire association presiding. Heard at this time was Bartlett T. Miller, general commercial manager of the New England Tel. & Tel. Co. on the subject "Civilian Defense". Louis Pitcher, executive vice president of the USITA was also scheduled to speak at this session but was unable to be present because of pressing Association affairs at Washington, D. C.

After the meeting of the Maine Association held at noon, the combined associations, presided over by Charles N. Foote, president of the Vermont association, heard Anna M. Griffin of Boston, Francis X. Welch of Washington and John T. Conway of Boston address them.

The morning of the third day started with the meeting of the New Hampshire association. Following this W. J. Thompson, president of the Maine Association called the final session and presented Earle J. St. Clair, William J. Homans, Boston, and Dr. Harold R. Bruce, Hanover, New Hampshire. Following these addresses the convention adjourned.

Nephew in RAF Says "War Is Hell"

J. W. Walton of the Oklahoma Telephone company, Broken Arrow, Okla., received a letter from his nephew from England, who is a first officer in the service of the Royal Air Force and at present is stationed in England, teaching navigation and instrument flying in all types of aircraft.

He states he likes England and is receiving wonderful treatment. He expects to return to the United States next June and plans on visiting the Waltons at Broken Arrow.

He says he has seen a little enemy action and it is not a pleasant sight to witness. He agrees with Sherman that "War is Hell."

He concludes his letter by saying he is getting to be a confirmed "tea drinker."

Wire Chief's Examination No. 7

OPEN WIRE CONSTRUCTION

1. Why is the matter of proper clearance so important in open wire construction work?
2. How much vertical clearance should be given a telephone cable which passes under a 33,000 volt power line?
3. Is two feet vertical clearance between a telephone wire and a 220 volt power line considered satisfactory? The point at which the telephone wire crosses under the power line is 10 feet from the nearest pole.
4. What is the standard vertical clearance for telephone lines crossing main highways? For telephone lines crossing railroad tracks?
5. What is the breaking strength in pounds of #12-BB, #12-85 steel, #12-135 steel, #102 copperweld and #14-40 copperweld wire?
6. On what type of line is each of the following insulators most suitable—(1) Pony (2) Double Petticoat (3) Pyrex (4) Single Petticoat?
7. Why is it highly important that the wire ends being spliced together be carefully burnished before insertion in the sleeve?
8. What are the three principal advantages of the compression type splicing method?
9. Of what use are the new compression type sleeves which are available in 7" to 10" lengths?
10. How are offset compression sleeves used?

Quantitative Design of Central Office Equipment

(Continued from page 21)

and special circuits of all kinds.

C. The total number of originating calls per day (in the form of peg counts for each peg count day for at least each of the latest twelve calender months).

D. The total number of originating calls during the busy hour (as disclosed by the peg counts for each peg count day for at least each of the latest twelve calendar months).

E. The total number of incoming trunked calls classified as to mehtod of operating (ring down, order wire, long distance, straightforward).

F. The total number of outgoing trunked calls classified as to method of operating (ring down, order wire, long distance, straightforward).

Note:—Items C to F inclusive are preferably shown by hours of the day except that the period from 12 midnight to 6 A. M. is usually recorded on the peg count form in the same way as the individual hours for the rest of the 24 are recorded.

G. The average length of conversation in seconds based upon the the actual timing of as large a number of calls as possible.

Note:—The average length of conversation must be translated into the average holding time of equipment per call, except in the very simplest types of Central Office of small size, in order to attain the degree of accuracy that is necessary. The average holding time is obtained from the average conversation time by a process of addition. Certain elements of the holding time such as the time required for answering, taking the calling subscriber's order, completing the mechanical operation incidental to establishing the connection in manual equipment, the called subscriber's answering time and the time required to remove the connection including the time required for signalling (sometimes called the disconnect time) obviously must be included to arive at the time during which the connecting equipment is held on the average connection.

In the case of dial equipment the same elements are included except that the work of the operator is not included but is replaced by the time that the switching equipment is engaged in the several stages of completing the call.

H. The total number of telephone stations to be served initially in the proposed new office and the number that will be served, according to the forecasts, ultimately, all classified as to the kind of service which they will require (individual, two-party, four-party, multi-party rural magneto and multi-party rural common battery).

I. The party line calling system which it is proposed to employ.

(To be continued)

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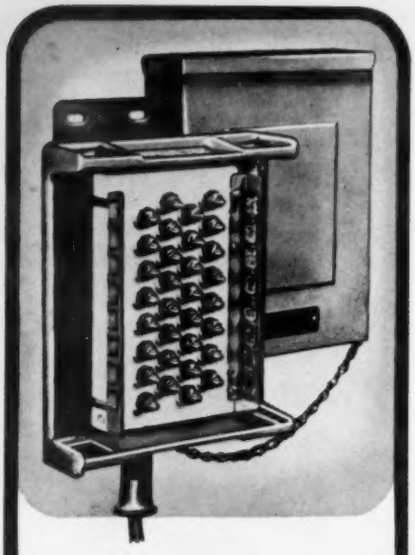

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AUTOMATIC ELECTRIC

TELEPHONE SIGNALING AND COMMUNICATION APPARATUS

Testing Switchboard Circuits and Equipment

(Continued from page 24)

checking the switchboard circuits. Advantage may be taken of the presence of the battery feed to use this current supply for actuating the head receiver or test lamp; though care must be taken not to introduce the external current into the ohmmeter when using the latter instrument for checking the circuits. It is a wise precaution to disconnect the battery feed from the circuit being tested with the ohmmeter to protect this instrument from damage.

It is not possible to apply the routine testing method described for the magneto cord circuit to similar circuits in common battery switchboards on account of the presence of battery feed in these circuits. However, since battery is available in the cord circuits, they may be checked for noise and cut-outs by connecting a head receiver to the tip and ring of the cord plug, using a jack box for facilitating the connection to the receiver, and listening in the the receiver while shaking the cord and moving the key levers. This test is made on each calling and answering cord. Since the sleeve side of the cord circuit is not tested by this method, the operation of the supervisory lamps should be checked by plugging the answering and calling cords into vacant line jacks. This operation lights the associated supervisory lights over the sleeve conductors of the cords. Flickering or darkening of these lamps on shaking the cords and turning the plugs in the jacks would indicate a defective sleeve conductor: though the jack connections should also be checked to make sure the trouble is not actually in this place.

Testing Multiple Jacks in Common Battery Switchboards

A very common source of trouble in common battery switchboards lies in defective connections in multiple jacks. Being continually subject to shocks and jars resulting from operators plugging in and out of jacks in multiples, connections at the jacks go open or become grounded or crossed with battery. Occassionally these defects take the form of an **intermittent fault** which is very difficult to locate owing to the tendency of this kind of fault coming clear when a test is made to locate the trouble.

In Figure 9 is illustrated a testing device utilizing a receiver with a pair of three-conductor cords and plugs for plugging into separate jacks of defective multiple. Connection is made to one of the three multiple wires by operating the proper kep on the testing device. Two vacant jacks in one of the switchboard sections, together with a signal lamp, are arranged for provid.. operating the proper key on the testing multiples, connection being made to the multiple under test by means of a patching cord. Intermittent grounds or crosses with battery are detected by darkening of the signal lamp if the trouble comes clear on plugging the test receiver into a defective jack.

To locate trouble in a multiple, the affected line is opened at the main frame by inserting cardboard insulators under the heat coils, the purpose being to prevent any outside condition from influencing the test. The proper test jack is then patched to the jack at the far end of the defective multiple. Battery or ground is connected to the multiple wire at fault by plugging the patching cord in the "Reverse" or 'Normal" jack, depending upon whether this wire is grounded or crossed with battery. This action sets up a current flow in the multiple wire which is detected by plugging the receiver cords in adjacent jacks of the multiple and listening in the test receiver while operating the proper key on the set (tip, ring, or sleeve). Faint clicks on on making and breaking the receiver circuit are produced by the potential drop between adjacent jacks connected

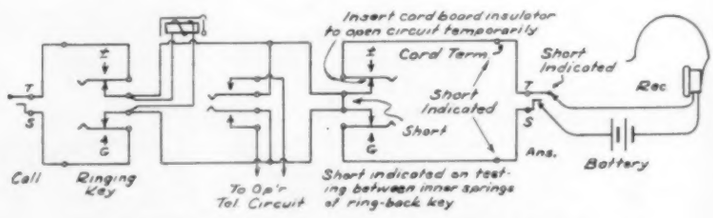

Fig. 7—Method of Locating a Short in a Magneto Cord Circuit.

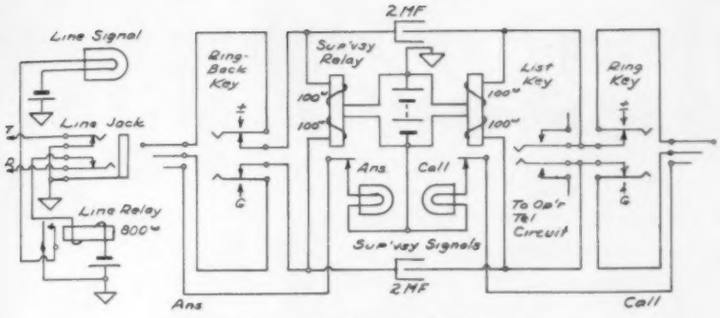

Fig. 8—Simple C.B. Line and Cord Circuit.

to the receiver and indicate that the receiver is between the fault and the jack patched to the current source. If no sound is heard, the fault is between the receiver and the patched jack.

An open in a ring or tip wire of a multiple is located by inserting a receiver equipped with a plug (tip and ring connected) into each jack of the multiple in turn. The current from the test jack patched to the end jack of the multiple will produce clicks in the receiver as each jack is tested. An open jack connection is indicated if no sound is heard in the receiver. If the open is an intermittent one, this trouble may be detected by tapping the jack under test. Clicks will be heard in the receiver if there is a loose connection between the wire and the jack spring lug. However, poor contact of the plug with the jack spring should be watched for in making this test.

An open in a sleeve wire may be detected by plugging a cord into each jack of the multiple and noting if the associated supervisory lamp will light. If the lamp remains darkened, an open sleeve wire to the affected jack may be suspected.

— To be continued —

Record Station Gain

There was a gain of about 110,600 telephones in service in the principal telephone subsidiaries of the American Telephone and Telegraph Company included in the Bell System during the month of August, 1941.

The gain for the previous month was 81,500 and for August, 1940, 66,300. The net gain for 8 months this year totals 865,600 as against 537,600 for the same period in 1940. At the end of August this year there were about 18,346,800 telephones in the Bell System.

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The gain for August 1941 was the largest for the month of August in the history of the Bell System, the next largest August gain having been 66,800 in 1936.

'Cash Register' Dial Patent

A patent on a new telephone device, which replaces the conventional dial with a cash register-like apparatus, was granted last week to Charles D. Richard, of West New Brighton, N. Y. Instead of dialing the number, the caller presses keys. Not only are the signals sent to the switchboard, where the party desired is automatically put on the line, but the number called appears on a dial on the telephone stand, enabling the caller to check possible wrong numbers. The patent is assigned to Bell Telephone Laboratories Inc., New York,

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Harold J. Barber

When Harold J. Barber, of Cleveland, vice president of The Ohio Bell Telephone Company, was recently elected president of N. C. Kingsbury Chapter, Telephone Pioneers of America, the pioneers also broke a long-established precedent and elected two women as vice-presidents.

Miss Mabel McDonnell, Ohio Bell division personnel supervisor, became the new vice president of the chapter's Akron council and Mrs. Bess Bolender, Ohio Bell supervisor instructor was elected vice president of the Columbus council.

Other new vice presidents, all Ohio Bell employees, are John C. Grusenmeyer, Dayton council; Clyde B. Calhoun, Zanesville council; Melvin A. Horne, Toledo council, and Frederick D. Walthour, Cleveland council. Each of these cities is the council headquarters for the section of the state in which it is situated.

Maps Completed

It is now possible for the Army Signal Corps to furnish all Army units with maps and charts showing all communication networks in any area of the nation. This data has been compiled by Major General J. O. Mauborgne, Chief Signal Officer of the Army. Data has been secured through excellent cooperation of the A. T. & T. Co., the Bell System Companies, the Independent Telephone Systems of the nation and the Telegraph Companies.

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Amortization of Defense Investments Discussed by NARUC

HOW the telephone companies, together with railroads and power and gas utilities, can amortize their excess plant investments which have been affected during the present defense emergency to serve the hundreds of army and navy encampments, air fields and bases and the hundreds of defense and airplane factories formed a dominant and most constructive keynote of the recent St. Paul convention of the National Association of Railroad and Utilities Commissioners.

The discussion of this question, coupled with the rising operating costs and taxes, took place at the first day's afternoon session, but was a subject of much consideration by the Federal and State commissioners in their conversations outside the convention hall. The consideration of this question and how utilities can amortize these plant expansions and investments so as to remove them from the general rate base after the war is over was actually made in the spirit of conservative judgment by the three commissioners who gave addresses at this session.

The only departure from this conservative and constructive viewpoint came in the report of the NARUC National Defense Program committee which was given by Tennessee Commissioner Leon Jourolmon who criticised in a most extensive way the alleged shortages of facilities and equipment in the railroad and electric power fields—the telephone industry was not included by him which, despite his later attack on that industry, was curious because it conveyed the impression that the telephone industry was fulfilling in every way the defense emergency needs.

The addresses of Commissioner Manly and Commissioner Ray L. Riley of California on the subject of amortization of investment provided extremely interesting food for thought for the NARUC membership and contained extremely practical and well-balanced ideas and views. Commissioner Riley proposed three methods of writing-off the defense plant investment and stressed that he felt that some of this property should be written off from the earnings which are available. He also warned that to meet inflation of wages and expenses and taxes facing the utilities the commissions should readily restore decreases in rates. "All reasonable steps to amortize property at this time should be taken," he warned, "and to the extent that earnings are available after such amortization, charges to the public should be reduced. Commissioner Manly stressed that the problem was one of "essentially" depreciation and where depreciation accural rates should be increased. He added that rate reductions obviously would not be justified where a utility is receiving large revenues during a brief period which may occur in the present situation.

Oregon Commissioner O. R. Bean, proposed that the NARUC create a committee immediately to study the entire picture of the plant amortization and possible increases of revenues. Unless socialization of utilities is to come, he warned that the regulatory bodies will have to develop their policies on adjustment of rates caused by emergency defense business and amortization of plant in a wise manner and with a consideration of the overall situations. He posed for the consideration of these problems by a NARUC committee a list of 24 questions which, in most cases, would appear to be impossible to answer not only at present but for the immediate future. In discussing the telephone industry, he mentioned the industry's agreement with the Federal Government to advance funds for the purchase and installation of emergency equipment at large army cantonments and naval bases to be paid back by deduction from revenue billing over a five-year period with my unpaid balance to be liquidated as a termination award.

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Western Elec. No. 323 Transmitters complete less backs @	1.00
Kellogg No. 2800 4-bar 1000 or 1600 ohm Bdg. Compacts @	9.25
Stromberg Carlson No. 896 5-bar 1600 ohm Bdg. Compacts @	10.75
Stromberg Carlson No. 896 3-bar 1000 ohm Bdg. Compacts @	8.00
Western Elec. No. 50 Latest type 3-bar Gen. with Crank Mtg. Screws @	2.75
Leich Elec. Transmitters with back & Mouthpiece @	.90
Kellogg No. 51 C. B. Ind Coils @	.35
Kellogg No. 41 Receivers with Shell and cord @	1.25
Kellogg No. 22 L. B. Transmitters with back and M. P. @	1.10

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